Effect of Small-Sided Games Verses High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football

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This Research Project is submitted as partial fulfilment of the requirements for the degree of Master of Science, St Mary`s University College

Declaration

I hereby certify that this material, which I now submit for assessment of the program of study leading to the award of Master of Science (MSc.) is entirely my own work, that I have exercised reasonable care to ensure that the work is original and, to the best of my knowledge, does not breach any law of copyright and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

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Abstract

Title: Effect of Small-Sided Games Verses High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football

Purpose: The purpose of this study was to investigate the effects of two training methods, Small-Sided Games (SSGs) and High-Intensity Intermittent Running (HIIR) on improving Acceleration and Repeated Sprint Ability (RSA) within Gaelic football players.

Methods: All participants conducted a pre-and post 10 m acceleration and RSA test, comprising of 7 x 30 m sprints with 25 seconds active recovery period in-between sprints. The study was conducted for a duration of 10 weeks, comprising of 20 intervention sessions. The SSGs protocol involved a 4 vs. 4 player format on an 80 m x 20 m pitch for a duration of 6 x 4 min. at above 85% HR_{max}, coupled with a 3-min. active recovery period of between 50-60% HR_{max}. Alternatively, the HIIR protocol involved participants completing a linear shuttle run at both the same duration and intensities as the SSGs. Thirty-two male club Gaelic football players (mean ± *SD*; Age: 26.1 ± 3.7 years; height: 179.0 ± 5.3 cm; body mass: 82.0 ± 7.9 kg; Body fat percentage: 12.4 ± 2.3 %; YYIR1 performance: 1358 ± 487 m) volunteered for the study. Internal physiological responses were measured during SSGs and HIIR sessions using a combination of heart rate monitoring collected at 5 s intervals and session rate of perceived exertion (s-RPE) data collected during each active recovery period.

Results: Post intervention results found no significant difference within 10 m acceleration (SSGs; 2.18 ± 0.13s vs. HIIR; 2.18 ± 0.19s) or RSA performance as outlined by RSA total time (SSGs; 45.97 ± 3.84s vs. HIIR; 45.40 ± 2.51s). It may be suggested the current training protocols lack the appropriate intensity levels to provide an overload stimulus to improve both acceleration and RSA. However, both groups

noted an improvement within maximal aerobic capacity, with the SSGs group showing the greatest improvement.

Conclusion: This study suggests that both training protocols are a valid method to increase maximal aerobic capacity, with SSGs offering the added benefit of aiding in improving players technical Gaelic football skills in tandem to aerobic conditioning.

Key words: Gaelic football, Acceleration, Repeated Sprint Ability, Intermittent exercise

Introduction

The field sport of Gaelic football is the most widely played native Irish sport in Ireland and abroad, due to the travel of Irish immigrants to countries such as the United Kingdom, USA, Canada and Australia (45,54). Gaelic football may be defined as a high-intensity intermittent team-based invasion field sport (37,13), sharing similar physical, physical and movement demands to field sports such as soccer, rugby and its sister sport of Australian football (11,16,39). The sport is played with two teams of 15 players on a rectangular grass pitch with measurements of 145 m long x 90 m wide with two H-shaped goals positioned on each end of the pitch (13). The aim of the sport is to outscore their opponent. Players can kick, hand pass or solo the ball from their foot to hand when in possession and block, tackle and intercept the ball when not in possession, a team is awarded 1 point if the ball is placed over the crossbar the H-shaped goal and 3 points if placed into the goal (37,45,47). Gaelic football competition is divided into two classifications, intercounty and club Gaelic football, commonly known as elite and sub-elite respectively, while game rules and pitch dimensions remain unchanged between classes, intercounty competitive games are 70 minutes in duration compared to club competitive game of 60 minutes (32,43).

Important game activities involve the regular requirement to complete recurrent bouts of high-intensity activity that taxes the anaerobic energy systems, such as accelerating, sprinting, tackling for possession, evading opponents and blocking opponents from scoring, this is combined with periods of low to moderate aerobic activity (13,15). As previously outlined by Keane at al. (27) who investigated the work rate within intercounty Gaelic football utilising 16 participants (n=16) over 8 competitive matches, found a significant percentage of game effort to be completed within low intensity activity, classified as walking and jogging at 66%, with high speed activity accounting for 16.1% such as striding and high-speed running. Similar

findings using time-motion analysis was recorded within senior male Gaelic footballers (*n*=55) with high-intensity activity, classified as running, shuffling and game related activity composing of 14.3% of total match intensity with the remaining 85.7% considered low to moderate intensity and classified as standing, walking, backing and jogging (38). A recent study utilising Global Positioning Systems (GPS) by Malone et al. (32) reported on running performance within intercounty Gaelic football players (*n*=50) with the average total distance covered during competitive play at 8,160 ± 1,482 m, high-speed running (≥17km·h^{-1}) 1,731 ± 659m, sprint running (≥22km·h^{-1}) 445 ± 269 m and the number of accelerations (≤ 6 s) at 184 ± 40. In comparison to movement demands within Australian football (AF) and soccer using GPS and video analysis, reported player total distance covered on average 12,939 ± 1145 m vs. 10,714 ± 991 m, high speed running (≥ 20 km·h^{-1}) 881 ± 341m vs. 2,492 ± 625 m, sprint running (≥ 23km·h^{-1}) 571 ± 285 m vs. 650 ± 6 m and number of accelerations (≤ 6s) at 150 ± 27 vs. 39.2 ± 2 (6,11,12,14,9).

Considering the travel demands of Gaelic football, players are required to have highly developed aerobic and anaerobic energy systems. The use of maximal aerobic capacity ($\dot{V}O_{2max}$) testing has been established as a valid and reliable indicator of aerobic fitness and cardiovascular endurance within field sports such as Gaelic football (50). As previously noted, maximal oxygen capacity levels for Gaelic footballers have been reported to be as large as 58.6 ml·kg^{-1}·min^{-1} compared to soccer 60.0 ml·kg^{-1}·min^{-1}, rugby 50.0 ml·kg^{-1}·min^{-1} and Australian football 57 ml·kg^{-1}·min^{-1} (4,16,18,54). Due to the high intensity efforts required during match play, typical peak maximal heart rate (HR_{max}) for Gaelic football players can reach up to 205 beats per minute with an average work load intensity of ≥80% HR_{max}, this can be compared to soccer where it is common for professional players to work at rate of ≥85% HR_{max} (22,7). A previous study investigating an 8-week sprint running protocol found a high

correlation (r = 0.63) between high aerobic capacity and match work rate within team sports, stating that players with high aerobic capacity can produce higher levels of effort during competitive play. It was also observed, team sports players with a high aerobic capacity can recover quicker during periods of high-intensity intermittent exercise (8). This outlines the importance for players to have highly developed aerobic and anaerobic energy systems to meet the competitive in game demands within club Gaelic football.

Within field sports such as soccer and rugby, the importance of the player's ability to accelerate has been shown to be crucial to match success (2,29). Acceleration may be described as the rate of change in velocity over time and is an important pre-cursor to high-speed and sprinting running (36,37). Within intercounty Gaelic football, published data has shown players to complete up to 96 high-intensity efforts, including acceleration lasting up to 7 seconds (sec), with less than 1.7% of total game time spent in high-intensity activities including acceleration (27,39). This is supported by published research within Gaelic football match position work rates, showing high-intensity activity accounting for the minority of in-play activity at between 12.8 ± 2.9 % to 19.8 ± 4.2 % and 16% total distance covered (27,39). Research in sprint activity within intercounty Gaelic football (n=50) found players on average covered 445 ± 169 m at sprint speed (≥ 22 $km \cdot h^{-1}$) and completed 184 ± 40 accelerations per game, this equated to 2.6 ± 0.5 accelerations per minute. Yet, it is within this limited window of the game period is responsible for the most critical moments in match success including winning possession, scoring, creating scoring chances or blocking a shot (46). For this reason, acceleration has become an important performance variable within Gaelic football.

A limitation within current research in acceleration, is the difficulty of standardising the classification of acceleration within field sports. Acceleration classifications have

been offered by Malone et al. (32) as a change in velocity by 2 $km \cdot h^{-1}$ within 1 sec. and change triggered by a movement more than 2 sec. in duration. Akenhead et al. (1) investigated acceleration patterns using GPS analysis on professional soccer players (*n*=36) and classified acceleration speed as low (1-2 $m \cdot s^{-2}$), moderate (2-3 $m \cdot s^{-2}$) and high (≥ 3 $m \cdot s^{-2}$), these values are supported by additional studies defining maximal acceleration at 2.78 $m \cdot s^{-2}$ within field sports (30).

Due to the unpredictable nature of Gaelic football, players are regularly challenged to undergo short durations of high-intensity activity coupled with brief periods of recovery at unspecified times (10,13). The ability for Gaelic football players to recover and maintain bouts of maximal effort sprints is known as repeated sprint ability (RSA) and deemed an important attribute within field sports (51,42). As previously noted, within competitive match play, Gaelic footballers spend up to 15.9% of total game in high-speed (≥ 22 $km \cdot h^{-1}$) running with work-to-rest ratios ranging from midfielders (1:7), backs (1:11) and forwards (1:14), suggesting midfielders are most susceptible to repeated sprint activity with reduced recovery periods during competitive play. RSA is characterised by high-intensity sprints of less than ≤ 6 sec. where peak power/velocity can be maintained through the activity coupled with recovery bouts of ≤ 30 sec., this is consistent with the recovery period with a competitive Gaelic football match of ≤ 37 sec. between bouts of activity (39,51).

Girard et al. (17) outlined two categories of RSA, Intermediate Sprint Exercise (ISE) described as short duration sprint running (≤ 10 sec) paired with a recovery period of between 60-300 sec. for full recovery. Alternatively, Repeated Sprint Exercise (RSE) which is characterised also by short duration sprint running (≤ 10 sec) paired with a recovery period of ≤ 60 sec. Due to the intermittent nature and positional demands of Gaelic football match play, both types of RSA are important with the ISE more

prominent due to the work-to-rest differences within positions. The need to produce repeated sprints within competitive play taxes the primary energy system of the adenosine triosphate-phosphcreatine (ATP-PCr), this system is characterised by the breakdown of phosphocreatine (PCr) stored in the skeletal muscle for energy to use for high-intensity activity for a maximal duration of ≤ 10 seconds due to the low available stores within skeletal muscle ranging from 70-80 mmol kg dry muscle (34). Owing to the low level of PCr. stores, PCr recovery periods can range from 70% in 30 sec. to 100% between 3-5 min (46). In a previous review on RSA tests by Spencer et al. (49) it was reported that within field sports mean sprint time (2-3 sec.) and sprint distance (10-12 m) remained reliable for the duration of the test, with a protocol of 6-7 sprints optimal to provide the desired intensity for RSA within field sports. This underpins the importance of RSA within club Gaelic football match success.

Anecdotal reports on Gaelic football physical preparation, commented on the primary training focus on aerobic conditioning with extensive steady state training of low to moderate intensity (≤ 75% maximal aerobic capacity) over long durations ≥ 45 minutes, the rational was superior aerobic capacity resulted in players deemed as competition ready. Limitations of such methods is that low steady state training is not representative of the requirements for players to interchange between aerobic and anaerobic energy systems, movement and exercise intensity demands required within competitive match play (44,50). Additional negative aspects include increased likelihood of overtraining injuries, due to the repetitive nature of steady state running and the prolonged duration of steady state training sessions (54).

With a view of replicating the match play demands within soccer and rugby, researchers have proposed the implementation of Small-Sided Games (SSGs) as a valid and reliable method to improve aerobic training while also allowing players to improve technical skills simultaneously (21,28). Physiological responses during

match play has shown typical peak maximal heart rate (HR_{max}) for Gaelic football players reaching up to 205 beats·min^{-1} with an average work load intensity of ≥ 80% HR_{max}, this can be compared to soccer where it is common for professional players to work at rate of ≥ 85% HR_{max} (22,10). Preceding research has outlined the use of High-Intensity Intermittent Running (HIIR) methods to replicate these intensities. Baker, 2011 (3) proposed a linear shuttle running method based on participants completing a maximal effort sprint for 15 sec. with a work-to-rest ratio of 1:1 at 100% - 120% Maximal Aerobic Speed (MAS) for a duration of between 5-10 minutes with reported improvements in aerobic power. Helgerud et al. (19) proposed an interval running protocol for the duration of 4 x 4 minutes with intensity levels set between 90-95% HR_{max} with 3 minutes active recovery and reported improvements in sprint activity of between 11-50% following an 8-week training program. In comparison, SSGs research within Gaelic Hurling (*n*=24) found with a 4 vs.4 SSG with a pitch size of 80m length x 20m width to illicit a ≥98 HR_{max} response, this is consistent with published values of 90-95% HR_{max} to improve maximal aerobic capacity (32,23). Within a recent study, researchers examined the effects of SSGs pitch size on performance variables within club hurling players (*n*=24) using a 4 vs. 4 player format by 6 x 4 minutes duration on a large pitch size (80m x 20m), reported results including number of total acceleration 35 ± 10, high accelerations (≥ 3 m·s^{-2}) 15 ± 10 and acceleration distance 101 ± 56m. This supports the potential use of SSGs as a method to improve performance variables such as acceleration and RSA, that is vital to Gaelic football match success.

A current void exists within club Gaelic football research, one of the key reasons is the majority of Gaelic football studies have relied on intercounty participants. This has resulted in researchers having to rely on data from studies based on intercounty or university Gaelic football team or similar sporting codes such as soccer, rugby and Australian football (44, 53, 36). This results in the complex task of comparing

physical and physiological club Gaelic football match demands with published research of similar sporting codes, for example the duration of match play within Gaelic football differs between Intercounty and Club competition (70 vs. 60 min. respectively) compared to Soccer (90 min.) and Rugby (80 min.). Sporting codes differences also exist within pitch dimensions, number of players on the field at any one time and tactical strategies used by team management (7). This outlines the importance of the current research study into club Gaelic football to enhance current evidence based research and best practice in improving club Gaelic football performance.

To the best of our knowledge, there exists no research studies investigating the effect of SSGs and HIIR on improving acceleration and RSA within club Gaelic football players. Therefore, the aim of this study is to investigate the effects of SSGs vs. HIIR protocols on improvements in acceleration and RSA performance within club Gaelic football players.

Methods

Experimental Approach to the Problem

This longitudinal cohort study consisted of thirty-two club Gaelic football players recruited and separated into two equal experimental groups based on their aerobic fitness levels as estimated by conducting a Yo-Yo Intermittent Recovery Test 1 (YYIR1). The two experimental groups were divided into Group 1) Small-Sided Games (SSGs) consisting of 16 participants and were conducted using a 4 vs. 4 player format. The field dimensions were set at 80 x 20 m (length x width) as outlined by Collins et al. (10). Group 2) The High-Intensity Intermittent Running (HIIR) group consisting of 16 participants and undertaking a linear running protocol comprised of a sub-maximal aerobic sprint at ≥85% HR_{max} for a duration of 7 seconds, finishing in a 5m deceleration zone at a work-to-rest ratio of 1:10 as previously noted by McErlean et al. (35). Internal and external training load data was collected during each training session using heart rate (HR) monitors (Team Polar System, Polar Electro Oy, Kempele, Finland) and session Rate of Perceived Exhaustion (s-RPE) based on Borg CR-10(11). Previous investigations by Lovell et al. (31) within professional rugby league players (n=32) reported a high correlation (r=0.62) between HR and s-RPE data in monitoring global training load, suggesting the use of s-RPE to be a useful tool to access players effort levels within intermittent field sports. Prior to the beginning of the study, all participants attended a familiarisation session to explain and demonstrate the physical and physiological data collection methods to be used. Physical and Physiological baseline measurements were collected one week prior to the research study. Each session was interspaced with a 24-hour rest period and players were requested to refrain from additional training away from the team.

Subjects

Thirty-two male club Gaelic football players (mean ± *SD*; Age: 26.1 ± 3.7 years; height: 179.0 ± 5.3 cm; body mass: 82.0 ± 7.9 kg; Body fat percentage: 12.4 ± 2.3 %; YYIR1 performance: 1358 ± 487 m) from the same team volunteered for the study. Participants were accepted once they met the inclusion criteria of being a male, current club Gaelic footballer, physically active 2-3 times per week, aged between 18-35 years old, non-smoker and have passed the PAR-Q with no history of metabolic and musculoskeletal diseases. As part of the health screening process, all participants had both blood pressure and resting heart rate levels collected using a digital Omron M6 AC ME automatic blood pressure monitor (Omron, Japan). Each participant was requested to remain in a relaxed supine position for 5 minutes before resting heart rate was recorded, resting heart rate was recorded three times with the mean used as the final resting heart rate. Ethical approval was sought and obtained from St. Marys University, Twickenham, UK. Ethics committee. Prior to beginning the study, the researcher conduced an information evening outlining the aims, methods, risks and benefits of the research study with the participants and presented each subject with a participant information sheet of the research study. Participant informed consent and a pre-activity readiness questionnaire (PAR-Q) forms were completed and collected from each participant prior to the study, and each participant was advised they could leave the study at any time.

Procedures

The study proposed of 20 SSGs vs. HIIR training sessions conducted over a 10-week period. All participants completed a 15 minute standardised warm-up incorporating light aerobic activity coupled with dynamic stretching and central nervous activation exercises known as the "GAA 15" warm-up (40). SSGs and HIIR sessions were conducted directly after the warm-up on a 3G artificial grass pitch (PTS sport, Tralee, Co Kerry, Ireland). All participants were supplied with a Team Polar HR belt and instructed on the correct placing of the device. HR data was recorded at 5 second intervals and only data collected during the intervention session was used for analysis. s-RPE was collected and recorded from each participant during their recovery phase in each training session and collected data transferred to a customised Microsoft Excel spreadsheet (Microsoft, Redmons, WA, USA). Individual HR_{max} was determined using the heart rate reserve method as outlined by Karvonen et al. (26). The SSGs group was divided into 4 teams of 4 participants and SSGs duration set for 6 x 4 minutes with a 3-minute recovery in between using regular GAA rules with no restrictions, additional footballs were placed on the boundaries of the pitches to ensure a quick turnover when the ball went out of play. To ensure the competitiveness of the SSGs once a game was completed, teams would rotate pitches to play a new team. The HIIR group undertook a linear sprint protocol consisting of a 7 second sprint over a distance based on their maximal aerobic speed as outlined by Baker (3), a work to rest ratio of 1:10 was enforced for full ATP-PCr recovery before participants underwent a full sprint effort. The HIIR group continued for 6 x 4 minute with a 3-minute recovery. In addition, all SSGs and HIIR sessions were conducted on the same time on each training session to reduce any variations in circadian rhythms (19:00-20:00 hrs).

Anthropometry

Baseline anthropometric data was collected prior to testing as outlined in Table 1. Height data was collected using a portable stradiometer bare feet (Seca 213, SECA, Birmingham, United Kingdom) and measured to the nearest 0.1 cm, while body mass was collected to the nearest 0.1 kg using a calibrated digital flat scale (Seca 887, SECA, Birmingham, United Kingdom) with participants in bare feet and minimal clothing. Body fat percentage was obtained using a Harpenden skinfold caliper (Baty International, West Sussex, United Kingdom) to collect 3 skinfold measurements from the pectoral, abdominal and front thigh locations in agreement with the protocols utilised by Cullen et al. (13). The 3 skinfold measurements of each site were added and the mean of each site was used for analysis. Body density was calculated by means of the Jackson and Pollock equation (24) and body fat percentage determined using the Siri equation (13).

Table 1. Physical characteristics of research study participants.

Physical characteristics	**Total (*n*=32)**		**SSGs (*n*=16)**		**HIIR (*n*=16)**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Age (yrs.)	26.1±3.7	26.1±3.7	27.3±3.9	27.3±3.9	24.9±3.2	24.9±3.2
Height (cm)	179±5.3	179±5.3	179±6.3	179±6.3	179.1±3.7	179.1±3.7
Weight (kg)	82.0±7.9	80.5±7.0	83.1±8.9	81.5±7.3	80.8±6.9	79.6±6.8
Body fat percentage (%)	12.4±2.3*	10.8±1.5*	13.3±1.7*	11.2±1.4*	11.5±2.5*	10.4±1.5*

Note. SSGs= Small-Sided Games, HIIR= High-Intensity Intermittent Running. Values are means ± SD, * p=<0.05.

Yo-Yo Intermittent Recovery Test Level 1 (YYIR1)

The YYIR1 has been proven to be a valid and reliable test to evaluate maximal aerobic capacity within intermittent field sports such as soccer (5). Participants were

required to complete a pre-and post-intervention YYIR1 test according to the procedures outlined by Bangsbo et al. (5) on a 3G artificial grass pitch with a shuttle distance of 20 m x 5 m in length measured out with a digital measuring wheel (Trumeter 5505E Digital Measuring Wheel, Trumeter, Bury, Lancashire, United Kingdom). Participants were divided into two separate groups to ensure the accurate recording of distances and participant control, group two underwent the test 5 minutes after group 1 finished. The test involves players performing a series of 2 x 20 m linear shuttle runs coupled with a 5-m recovery zone to the pace set by an audio compact disk (BangsboSport.com, Copenhagen, Denmark) with a rest period of 5 seconds between shuttles. The YYIR1 starting speed is set at 10 $km \cdot h^{-1}$ and increases up to 19 $km \cdot h^{-1}$, the test continues until participants fatigue and withdraw or dismissed due to been unable to maintain pace with the audio beep. The tester records the final distance completed by the participant and estimates participants maximal aerobic capacity ($\dot{V}O_{2max}$) using the Bangsbo et al. (5) formula of YYIR1 (m) x 0.0084 + 36.4 = $\dot{V}O_{2max}$ ($ml \cdot kg^{-1} \cdot min^{-1}$).

Maximal Aerobic Speed (MAS)

Maximal Aerobic Speed may be defined as the minimal running speed at which $\dot{V}O_{2max}$ occurs and is used as a measure of anaerobic power (3). To calculate participants MAS, all participants underwent a pre-and post one kilometre (1km) maximal effort time trial (33) wearing running trainers on an 800 m Conipur SP outdoor running track (Crawford Group, Co. Antrim, Northern Ireland). Participants were distributed into 4 groups of 8 participants for the testing to ensure correct recording of each participant's times. Data was collected using a digital Seiko SO51 100 Lap Memory Stopwatch (Seiko, Japan). As noted by Hezler et al. (20) the use of handheld stopwatches reported small mean errors and high intraclass correlations

against electronic timing gates, making them a viable method in collecting group data where the use of electronic timing gates is not feasible.

Acceleration Test

Acceleration is to be investigated using a 10-m linear sprint test as outlined by Little and Williams (29). Testing involved participants sprinting at maximal effort over a 10-m distance from a stationary start. A Brower TC motion sensor was placed at the start line and an electronic gate placed 10 m in front, set to a width of 2 m and height of 1 m. (Brower TC-Timing Systems, Salt Lake City, USA). Participants were instructed to place their front foot on the starting line with the TC motion sensor in line with their rear foot position, once ready the acceleration test begun when the participant's rear foot left the ground and activated the TC motion sensor. Each participant performed three sprints with a recovery period of 60 seconds between sprints to ensure full ATP-PCr recovery. The quickest sprint time was recorded and used for analysis.

Repeated Sprint Ability (RSA) Test;

The use of RSA testing has shown to be an important indicator for anaerobic fitness within intermittent field sports such as soccer (42). Within top-level soccer players, a significant correlation has been shown with mean RSA sprint test results and running distances during competitive play (42). Within the present study, participants completed an RSA test as outlined by Perroni et al. in figure 1 (41).

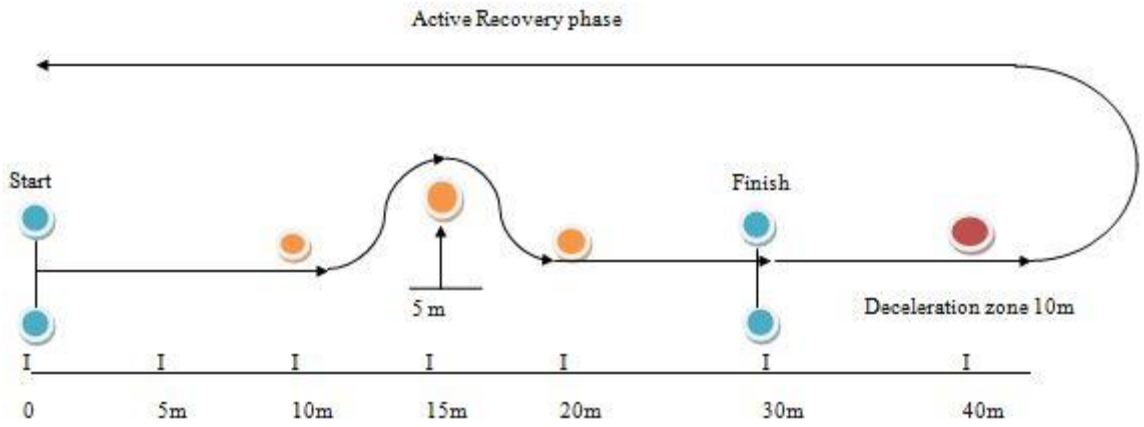

Figure 1. Design of the Repeated Sprint Ability test. Adapted from Perroni et al.(42).

To calculate RSA performance, a Brower TC motion sensor and electronic timing gates were used. The motion sensor was positioned at the start line to the same protocol as previously described. One electronic gate was placed at the finish line of the test (30m) using the same set up as previously described. Participants were instructed to complete 7 x 30 m sprints with a change of direction at the midway point at maximal effort, once crossing the finish line players decelerated as quickly as possible. The recovery phase was set at 25 sec. in duration with participants undertaking a light jog of 40 m to the starting line. Within the present study, the mean of RSA total sprint time, average sprint time and fatigue index percentage (FI %) results were considered representative of RSA performance. The FI % was calculated based on the difference in the slowest sprint time and the fastest sprint time FI % = ($[S_{slowest} - S_{fastest}]/S_{fastest}$) x 100 (17)

Small-sided Games (SSGs)

The SSGs group consisted on 16 participants divided into 4 teams of 4 players. Training consisted of a 4 vs. 4 game format with play duration of 6 x 4 min. (performed at 85-95% HR_{max}), with a 3-min. active recovery period (performed at 50-60% HR_{max}) on an 80 x 20 m pitch as reported by Collins et al. (10). Standard match rules apply and extra balls were placed onto the sidelines to ensure the continued flow of the game and limit the duration of stoppage when the ball is forced out of play.

High-Intensity Intermittent Running (HIIR)

The HIIR group consisted of 16 participants completing a series of maximal effort linear sprints of 7 seconds in duration coupled with a 70 second recovery period to ensure full ATP-PCr resynthesis (work-to-rest ratio of 1:10). Participants continued the protocol for the duration of 6 min. at ≥85% HR_{max} with a 3-min. active recovery period completed between 50-60% HR_{max} to ensure similar workloads within groups. Participants exercise intensity zones were based on maximal aerobic guidelines of 100% MAS equal to 93-100% HR_{max} by Baker 2011 (3). Participants were set individual travel distances based on their 1 km time trial to calculate their MAS (m/s). Participants shuttle travel distances were calculated at 100% MAS x 7 sec. to engage the anaerobic energy systems. For example, if a participant runs a 1 km time trail in 250 seconds, then their 100% MAS equals 4.0 m/s. 4.0 m/s is multiplied by the sprint time of 7 sec. resulting in a participant sprint distance of 28 m. Both groups underwent a standardised active recovery comprising of a light jog and a series of dynamic stretches.

Statistical Analyses

Research data is exhibited as mean values and standard deviation (means ± *SD*). Statistical analysis was performed using the statistical analysis software IBM SPSS (Version 24, IBM, New York, USA) with statistical significance was set at an alpha level of $p \leq 0.05$. Sample size was estimated using statistical power software, G*Power (version 3.0.10, Heinrich-Heine-University, Düsseldorf, Germany) showing a moderate/small/large effect size (f =61). A Shapiro-Wilk test was conducted to test the normal distribution of the data and a 2-way analysis of variance (ANOVA) was conducted to compare differences in the dependent variables of acceleration, RSA and fatigue index with pre-post time as a factor. A least significant difference (LSD) test was employed to make multiple evaluations between the dependent outcomes. Finally, for results displaying statistical significance a Tukey HSD post hoc test was conducted to investigate interactions between significant outcomes.

Results

Physical and physiological responses to SSGs vs. HIIR are presented in Table 2 with performance differences presented in figure 2 and 3. Results show there was no significant difference for acceleration (F (1,30) = 0.69, *p*= <0.794), RSA total time (F (1,30) = 0.078, *p*= <0.782) ,RSA average sprint (F (1,30) = 2.760, *p*= <0.107), Fatigue index % (F (1,30) = 0.012, *p*= <0.914), YYIRL1 (F (1,30) = 1.876, *p*= <0.18), Maximal aerobic capacity (F (1,30) = 1.872, *p*= <0.81), 1km TT ((F (1,30) = 0.563, *p*= <0.853), MAS (F (1,30) = 0.129, *p*= <0.72). A significant difference was recorded for body fat % (F (1, 30) = 4.338, *p*= <0.046) indicating a significant improvement for the research methods.

Table 2. Physical and physiological responses to SSGs vs. HIIR

	Total (*n*=32)		**SSGs (*n*=16)**		**HIIR (*n*=16)**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
10 m acceleration (s)	2.22 ± 0.15	2.18 ± 0.11	2.27 ± 0.33	2.18 ± 0.13	2.22 ± 0.14	2.18 ± 0.19
RSA total time (s)	45.16 ± 1.83	45.68 ± 3.23	45.60 ± 1.85	45.97 ± 3.84	44.73 ± 1.75	45.40 ± 2.51
RSA avg. sprint time (s)	6.45 ± 0.26	6.58 ± 0.39	6.55 ± 0.26	6.68 ± 0.4	6.39 ± 0.25	6.49 ± 0.36
Fatigue Index (%)	3.86 ± 1.58	4.41 ± 2.53	3.92 ± 1.46	4.28 ± 2.47	3.8 ± 1.74	4.55 ± 2.65
$\dot{V}_{O_2}max$ ($ml \cdot kg^{-1} \cdot min^{-1}$)	47.8 ± 4.1	48.40 ± 3.7	47.80 ± 4.3	49.2 ± 3.7	47.80 ± 4.0	47.60 ± 3.7
Training intensity (bpm)	158.0 ± 9.26	163.0 ± 5.21	160.0 ± 8.4	169.0 ± 5.28	156.0 ± 10.12	157.2 ± 6.29
Perception of effort (s-RPE)	6.0 ± 0.72	5.0 ± 0.51	6.0 ± 0.63	5.0 ± 0.53	6.0 ± 0.84	5.0 ± 0.49

Note. SSGs= Small-Sided Games, HIIR= High-Intensity Intermittent Running. 10m acceleration results based on best sprint, RSA average sprint time is calculated from the mean of 7 completed RSA sprints. s-RPE= Session Rate of Perceived Exhaustion. Values are means ± SD, * *p*=<0.05.

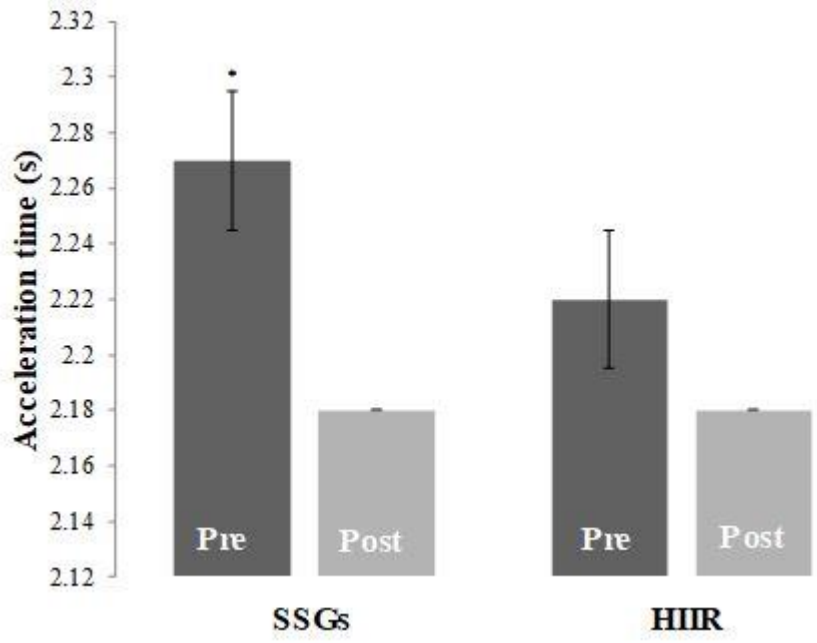

Figure 2. Changes in Acceleration for SSGs vs. HIIR groups Values are mean ± SD, * p = <0.05

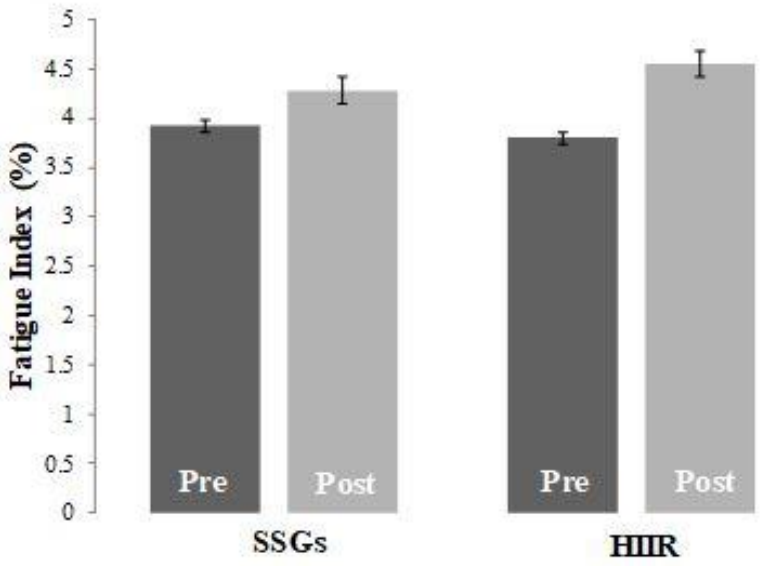

Figure 3. Changes in fatigue index (%) for SSGs vs. HIIR groups Values are mean ± SD, * p = <0.05

Discussion

The objective of the current study is to investigate the effect of SSGs vs. HIIR to improve acceleration and RSA within club Gaelic football players. Results from the 10-m acceleration test, showed minor improvements from pre to post analysis in both the SSGs and HIIR groups (SSGs; 2.27 ± 0.33s - 2.18 ± 0.13s, HIIR; 2.22 ± 0.14s - 2.18 ± 0.19s), these shared similar results to published data on 10 m sprint times within intercounty Gaelic footballers of 1.89 ± 0.17s and 2.06 ± 0.10s (10,39). This suggests the results are consistent with elite level players and any improvements by club players would be minimal. This may be explained by the demands of the sport, where players are needed to generate high levels of power, as described as the level of work a muscle or muscle group can create per unit of time (48). Since power is created in the neuromuscular system and affected by motor unit recruitment, players who undertake both strength and power based training as part of their physical preparation program can expect to develop Type 11a & Type 11x muscle fibers. Wisløff et al. (55) commented on the strong correlation between maximal half-squat strength and 10 m sprint performance within international soccer players (n = 17), this suggests the use of a high-intensity effort of ≥ 95% 1RM to illicit a neuromuscular training effect and aid in producing explosive efforts over short periods.

With regards to RSA performance, both the SSGs and HIIR groups reported an increase in total RSA test times (SSGs; 45.60 ± 1.85s - 45.97 ± 3.84s, HIIR; 44.73 ± 1.75s - 45.40 ± 2.51s) these can be compared to 12 rugby league players RSA total test time of 41.5 ± 3.2 s (25). Both groups also displayed an increase in RSA average sprint times (SSG; 6.55 ± 0.26s - 6.68 ± 0.4s, HIIR; 6.39 ± 0.25s - 6.49 ± 0.36s) compared to professional soccer players (n = 41) with an average RSA sprint time of 7.25 ± 0.17 s. Finally, results reported an increase in the fatigue index percentage of both groups, considering that the FI % is an indicator of players anaerobic capacity,

this increase indicated the players power output as declining and signifies the rate of fatigue during bouts of maximal sprint running (SSGs; 6.55 ± 0.26 s - 6.68 ± 0.4 s, HIIR; 6.39 ± 0.25 s - 6.49 ± 0.36s). The use of three methods to measure RSA offers the researcher a global understanding on the effects of RSA on Gaelic football performance. Interestingly within this study, club Gaelic footballers compared favourably to similar fields sport and against results from professional athletes, considering club Gaelic football is considered sub-elite. Considerations should also be noted that due alternative methods of RSA testing and data collection, direct comparisons should be viewed with caution. Physiological effect of RSA within energy system as the need for additional bouts of high-intensity activity results in a decline acute decline in ATP and PCr stores. It is during this period that the aerobic system is required to aid in recovery. Turner and Stewart (50) discussed the effects of fatigue on RSA and noted the build up of hydrogen (H^+) ions the main factor in muscular fatigue due to a process of reducing intracellular pH balance and the inhabitation of binding enzymes to produce muscular contraction. This reduction in RSA may also be coupled with a reduction in the optimal functioning of the sodium potassium pump and with the reduction of calcium influencing the hydrolysis of ATP via the pump. It is also noted that player position affects the ability for players to fully re synthesis ATP-PCr stores, for example McErlean et al. (35) found work-top-rest ratios for back (1:16.6), forwards (1:11.6) and midfielders (1:7.4) within intercounty Gaelic footballers. This offers an insight to the limited recovery period for midfielders compared to back and forward players, this is supported by Malone et al. (32) within elite Gaelic footballers (n = 43), reporting an average total match distances of 9,523 m compared to full-backs of 6,892 m and full-forwards at 7,090, also noted was midfielders were responsible for a higher number of acceleration of 219 compared to full back and full forward positions of 152 and 152 respectively. It may be noted, that an alternative reason for the study recording minor improvements within acceleration

and RSA is the prescribed intensity levels, previous research with SSGs and club Gaelic football by Collins et al. (10) implemented a similar SSGs regime with HR_{max} set at between 85-95% $HR_{max,}$ with results showing no improvement in 5 m sprint speed. This can be compared to Hill-Hass et al. (21) who implemented a similar SSG (4 vs. 4) method at $\geq$ 95% HR_{max} with reported improvements in maximal aerobic capacity, this suggests the current research method to target intensity levels of 85% HR_{max} to be insufficient to illicit an overload training stimulus.

A noted limitation within the study is unavailability of time-motion analysis such as GPS to collect and categorise the number of accelerations conducted within the SSGs and HIIR groups. As described within the introduction, accelerations by distance may be described as low ($\geq$ 1-2 $m \cdot s^{-1}$), moderate ($\geq$ 2-3 $m \cdot s^{-1}$) and high accelerations ($\geq$ 3$m \cdot s^{-1}$) and GPS analysis may offer more in-depth information of the types of acceleration more prominent with SSGs and may lead to developing appropriate SSGs to improve acceleration within Gaelic football. Yet, caution should be noted within applying GPS to monitor acceleration as a current study by Vardey et al. (52) commented on the limitations of GPS with sampling rates of $\leq$ 5Hz to correctly track and collect data within short duration activity, it was reported a 10Hz to be the optimal sampling frequency to collect acceleration data from.

In conclusion, the aim of the study was to compare SSGs against HIIR to investigate possible methods to improve acceleration and RSA within club Gaelic football players. No significance differences were shown between the SSGs and HIIR groups, with only minor improvements within 10 m acceleration and aerobic capacity. It is recommended future studies to implement and monitor a high-intensity SSGs and HIIR training program with real time HR analysis to investigate if RSA can be improved.

Practical applications

It is suggested for the Strength and Conditioning coach to implement the use of SSGs within a field sports team physical preparation, especially during the in-season, as benefits include; 1) Improvements in maximal aerobic capacity, 2) Improvements within ball control and handling skills due to the nature of SSGs. 3) Improved player response and training interest with the implementation of SSGs due to its similarity to competitive play.

References

1. Akenhead R, Hayes PR, Thompson KG, French D. Diminutions of acceleration and deceleration output during professional football match play. *Journal of Science and Medicine in Sport*. 2013 Nov 30;16(6):556-61.

2. Baker DG, Newton RU. Comparison of lower body strength, power, acceleration, speed, agility, and sprint momentum to describe and compare playing rank among professional rugby league players. *The Journal of Strength & Conditioning Research*. 2008 Jan 1;22(1):153-8.

3. Baker D. Recent trends in high-intensity aerobic training for field sports. *Professional Strength & Conditioning*. 2011;22:3-8.

4. Bangsbo J. The physiology of soccer--with special reference to intense intermittent exercise. *Acta Physiological Scandinavica. Supplementum*. 1993 Dec; 619:1-55.

5. Bangsbo J, Iaia FM, Krustrup P. The Yo-Yo intermittent recovery test. *Sports medicine*. 2008 Jan 1;38(1):37-51.

6. Bradley PS, Sheldon W, Wooster B, Olsen P, Boanas P, Krustrup P. High-intensity running in English FA Premier League soccer matches. *Journal of sports sciences.* 2009 Jan 1;27(2):159-68.

7. Brown J, Waller M. Needs analysis, physiological response, and program guidelines for Gaelic football. *Strength & Conditioning Journal*. 2014 Apr 1;36(2):73-81.

8. Buchheit M, Ufland P. Effect of endurance training on performance and muscle reoxygenation rate during repeated-sprint running. European journal of applied physiology. 2011 Feb 1;111(2):293-301.

9. Carling C, Bloomfield J, Nelsen L, Reilly T. The role of motion analysis in elite soccer. *Sports medicine*. 2008 Oct 1;38(10):839-62.

10. Collins K, Doran D, Reilly T. Small-Sided Games present and effective training stimulus in Gaelic football. *In Science and Football VII*: The Proceedings of the Seventh World Congress on Science and Football 2013 May 2 (p. 379). Routledge.

11. Coutts AJ, Rampinini E, Marcora SM, Castagna C, Impellizzeri FM. Heart rate and blood lactate correlates of perceived exertion during small-sided soccer games. *Journal of Science and Medicine in Sport*. 2009 Jan 31;12(1):79-84.

12. Coutts AJ, Quinn J, Hocking J, Castagna C, Rampinini E. Match running performance in elite Australian Rules Football. *Journal of Science and Medicine in Sport*. 2010 Sep 30;13(5):543-8.

13. Cullen BD, Cregg CJ, Kelly DT, Hughes SM, Daly PG, Moyna NM. Fitness profiling of elite level adolescent Gaelic football players. *The Journal of Strength & Conditioning Research.* 2013 Aug 1;27(8):2096-103.

14. Dawson B, Hopkinson R, Appleby B, Stewart G, Roberts C. Player movement patterns and game activities in the Australian Football League. *Journal of Science and Medicine in Sport*. 2004 Sep 1;7(3):278-91.

15. Florida-James G, Reilly T. The physiological demands of Gaelic football. British *Journal of Sports Medicine*. 1995 Mar 1;29(1):41-5.

16. Gabbett TJ. Physiological characteristics of junior and senior rugby league players. *British Journal of Sports Medicine*. 2002 Oct 1;36(5):334-9.

17. Girard O, Mendez-Villanueva A, Bishop D. Repeated-sprint ability—Part I. *Sports medicine*. 2011 Aug 1;41(8):673-94.

18. Gray AJ, Jenkins DG. Match analysis and the physiological demands of Australian football. *Sports Medicine*. 2010 Apr 1;40(4):347-60.

19. Helgerud J, Hoydal K, Wang E, Karlsen T, Berg P, Bjerkaas M, Simonsen T, Helgesen C, Hjorth N, Bach R, Hoff J. Aerobic High-Intensity Intervals Improve VO~ 2~ m~ a~ x More Than Moderate Training. *Medicine and science in sports and exercise*. 2007 Apr 1;39(4):665.

20. Hetzler RK, Stickley CD, Lundquist KM, Kimura IF. Reliability and accuracy of handheld stopwatches compared with electronic timing in measuring sprint performance. *The Journal of Strength & Conditioning Research*. 2008 Nov 1;22(6):1969-76.

21. Hill-Haas S, Coutts A, Rowsell G, Dawson B. Variability of acute physiological responses and performance profiles of youth soccer players in small-sided games. *Journal of science and medicine in sport*. 2008 Sep 30;11(5):487-90.

22. Hoff J, Helgerud J. Endurance and strength training for soccer players. *Sports medicine*. 2004 Mar 1;34(3):165-80.

23. Impellizzeri FM, Marcora SM, Castagna C, Reilly T, Sassi A, Iaia FM, Rampinini E. Physiological and performance effects of generic versus specific aerobic training in soccer players. *International journal of sports medicine*. 2006 Jun;27(06):483-92.

24. Jackson AS, Pollock ML. Generalized equations for predicting body density of men. *British journal of nutrition.* 1978 Nov 1;40(03):497-504.

25. Johnston RD, Gabbett TJ. Repeated-sprint and effort ability in rugby league players. *The Journal of Strength & Conditioning Research*. 2011 Oct 1;25(10):2789-95.

26. Karvonen MJ, Kentala E, Mustala O. The effects of training on heart rate; a longitudinal study. *InAnnales medicinae experimentalis et biologiae Fenniae* 1957 (Vol. 35, No. 3, p. 307).

27. Keane S, Reilly T, Hughes M. Analysis of work-rates in Gaelic football. Australian *Journal of Science and Medicine in Sport.* 1993; 25:100-.100.

28. Kennett DC, Kempton T, Coutts AJ. Factors affecting exercise intensity in rugby-specific small-sided games. *The Journal of Strength & Conditioning Research*. 2012 Aug 1;26(8):2037-42.

29. Little T, Williams AG. Specificity of acceleration, maximum speed, and agility in professional soccer players. *The Journal of Strength & Conditioning Research*. 2005 Feb 1;19(1):76-8.

30. Lockie RG, Murphy AJ, Knight TJ, de Jonge XA. Factors that differentiate acceleration ability in field sport athletes. *The Journal of Strength & Conditioning Research*. 2011 Oct 1;25(10):2704-14.

31. Lovell TW, Sirotic AC, Impellizzeri FM, Coutts AJ. Factors affecting perception of effort (session rating of perceived exertion) during rugby league training. *International journal of sports physiology and performance*. 2013 Jan;8(1):62-9.

32. Malone S, Solan B, Collins K, Doran D. The metabolic power and energetic demands of elite Gaelic football match play. *The Journal of sports medicine and physical fitness*. 2016 Mar 1;13 (4)

33. Malone S, Roe M, Doran DA, Gabbett TJ, Collins KD. Protection Against Spikes in Workload with Aerobic Fitness and Playing Experience: The Role of the Acute: Chronic Workload Ratio on Injury Risk in Elite Gaelic Football. International Journal of Sports Physiology & Performance. 2017 Mar 1;12(3).

34. McArdle WD, Katch FI, Katch VL. *Essentials of exercise physiology*. Lippincott Williams & Wilkins; 2006.

35. McErlean CA, Cassidy J, O'Donoghue PG. Time-motion analysis of gender and positional effects on work-rate in elite Gaelic football competition. *Journal of Human Movement Studies*. 2000 Jan 1;38(5):269-86.

36. McGinnis P. *Biomechanics of sport and exercise.* Human Kinetics; 2013.

37. McIntyre MC, Hall M. Physiological profile in relation to playing position of elite college Gaelic footballers. *British journal of sports medicine*. 2005 May 1;39(5):264-6.

38. Osgnach C, Poser S, Bernardini R, Rinaldo R, Di Prampero PE. Energy cost and metabolic power in elite soccer: a new match analysis approach. *Med Sci Sports* Exerc. 2010 Jan 1;42(1):170-8.

39. O'Donoghue P, King S. Activity profile of men's Gaelic football. In Science and Football V: The Proceedings of the Fifth World Congress on Sports Science and Football 2005 May 27 (p. 207). Routledge.

40. O'Malley E, Murphy JC, Persson UM, Gissane C, Blake C. The effects of the GAA 15 training program on neuromuscular outcomes in Gaelic football and hurling players; a randomized cluster trial. The Journal of Strength & Conditioning Research. 2017 Jan 4.

41. Perroni F, Corvino M, Cignitti L, Minganti C. RSA response to preseason training in semiprofessional soccer players. *Sport Sciences for Health*. 2013 Aug 1;9(2):59-64.

42. Rampinini E, Sassi A, Morelli A, Mazzoni S, Fanchini M, Coutts AJ. Repeated-sprint ability in professional and amateur soccer players. *Applied Physiology, Nutrition, and Metabolism*. 2009 Nov 18;34(6):1048-54.

43. Reeves S, Collins K. The nutritional and anthropometric status of Gaelic football players. *International journal of sport nutrition and exercise metabolism*. 2003 Dec;13(4):539-48.

44. Reilly T, Collins K. Science and the Gaelic sports: Gaelic football and hurling. *European Journal of Sport Science*. 2008 Sep 1;8(5):231-40.

45. Reilly T, Doran D. Science and Gaelic football: A review. *Journal of Sports Sciences.* 2001 Jan 1;19(3):181-93.

46. Reilly T, Gilbourne D. Science and football: a review of applied research in the football codes. *Journal of Sports Sciences.* 2003 Sep 1;21(9):693-705.

47. Ryan M, Malone S, Collins K. An Acceleration Profile of Elite Gaelic Football Match-Play. The *Journal of Strength & Conditioning Research*. 2017 Apr 21.

48. Sale DG. Neural adaptation to resistance training. *Medicine and science in sports and exercise*. 1988 Oct;20(5 Suppl): S135-45.

49. Spencer M, Bishop D, Dawson B, Goodman C. Physiological and metabolic responses of repeated-sprint activities. *Sports Medicine*. 2005 Dec 1;35(12):1025-44.

50. Strudwick A, Doran TR. Anthropometric and fitness profiles of elite players in two football codes. *Journal of sports medicine and physical fitness*. 2002 Jun 1;42(2):239.

51. Turner AN, Stewart PF. Repeat sprint ability. *Strength & Conditioning Journal*. 2013 Feb 1;35(1):37-41.

52. Varley MC, Fairweather IH, Aughey1, 2 RJ. Validity and reliability of GPS for measuring instantaneous velocity during acceleration, deceleration, and constant motion. *Journal of sports sciences*. 2012 Jan 1;30(2):121-7.

53. Wadley G, Le Rossignol P. The relationship between repeated sprint ability and the aerobic and anaerobic energy systems. *Journal of Science and Medicine in Sport*. 1998 Jun 1;1(2):100-10.

54. Watson AW. Physical and fitness characteristics of successful Gaelic footballers. *British journal of sports medicine*. 1995 Dec 1;29(4):229-31.

55. Wisløff U, Castagna C, Helgerud J, Jones R, Hoff J. Strong correlation of maximal squat strength with sprint performance and vertical jump height in elite soccer players. British journal of sports medicine. 2004 Jun 1;38(3):285-8.

Appendices

Appendix 1

Ethics Submission form

St Mary's University Twickenham London

St Mary's University

Ethics Sub-Committee

Application for Ethical Approval (Research)

This form must be completed by any undergraduate or postgraduate student, or member of staff at St Mary's University, who is undertaking research involving **contact with, or observation of, human participants.**

Undergraduate and postgraduate students should have the form signed by their supervisor, and forwarded to the School Ethics Sub-Committee representative. Staff applications should be forwarded directly to the School Ethics Sub-Committee representative. All supporting documents should be merged into one PDF (in order of the checklist) and clearly entitled with your Full Name, School, Supervisor.

Please note that for all undergraduate research projects the supervisor is considered to be the Principal Investigator for the study.

If the proposal has been submitted for approval to an external, properly constituted ethics committee (e.g. NHS Ethics), then please submit a copy of the application and approval letter to the Secretary of the Ethics Sub-Committee. Please note that you will also be required to complete the St Mary's Application for Ethical Approval.

Before completing this form:

- **Please refer to the University's Ethical Guidelines. As the researcher/ supervisor, you are responsible for exercising appropriate professional judgment in this review.**
- **Please refer to the Ethical Application System (Three Tiers) information sheet.**
- **Please refer to the Frequently Asked Questions and Commonly Made Mistakes sheet.**
- **If you are conducting research with children or young people, please ensure that you read the Guidelines for Conducting Research with Children or Young People, and answer the below questions with reference to the guidelines.**

Please note:

In line with University Academic Regulations the signed completed Ethics Form must be included as an appendix to the final research project.

If you have any queries when completing this document, please consult your supervisor (for students) or School Ethics Sub-Committee representative (for staff).

St Mary's University Twickenham London

St Mary's Ethics Application Checklist

The checklist below will help you to ensure that all the supporting documents are submitted with your ethics application form. The supporting documents are necessary for the Ethics Sub-Committee to be able to review and approve your application.

Please note, if the appropriate documents are not submitted with the application form then the application will be returned directly to the applicant and may need to be re-submitted at a later date.

	Enclosed? (delete as appropriate)		Version No
Document	**Yes**	**Not applicable**	
1. Application Form	**Mandatory**		
2. Risk Assessment Form	**Yes**		
3. Participant Invitation Letter		**N/A**	
4. Participant Information Sheet	**Mandatory**		
5. Participant Consent Form	**Mandatory**		
6. Parental Consent Form		**N/A**	
7. Participant Recruitment Material - e.g. copies of Posters, newspaper adverts, website, emails	**Yes**		
8. Letter from host organisation (granting permission to conduct the study on the premises)		**N/A**	
9. Research instrument, e.g. validated questionnaire, survey, interview schedule		**N/A**	
10. DBS (to be sent separately)		**N/A**	
11. Other Research Ethics Committee application (e.g. NHS REC form)		**N/A**	
12. Certificates of training (required if storing human tissue)		**N/A**	

I can confirm that all relevant documents are included in order of the list and in one PDF document (any DBS check to be sent separately) named in the following format:

Mark O`Connell,

School of Sports, Health and Applied Science.

Dr. Stephen Patterson

Signature of Applicant:

Signature of Supervisor:

St Mary's University Twickenham London

Ethics Application Form

1) Name of proposer(s)	**Mark O`Connell**
2) St Mary's email **address**	**145615@live.smuc.ac.uk**
3) Name of supervisor	**Dr. Stephen Patterson**

4) Title of project "The effects of **Small-Sided Games Verses High-Intensity Intermittent Running on** Acceleration and Repeated Sprint Ability in Gaelic Football"

5) School or service	**Sports, Health and Applied Science**
6) Programme (whether undergraduate, postgraduate taught or postgraduate research)	**Postgraduate thought**
7) Type of activity/research (staff/undergraduate student/postgraduate student)	**Postgraduate student**

8) Confidentiality	
Will all information remain confidential in line with the Data Protection Act 1998?	**YES**

9) Consent	
Will written informed consent be obtained from all participants/participants' representatives?	**YES**

10) Pre-approved protocol	
Has the protocol been approved by the Ethics Sub-Committee under a generic application?	**NO**

11) Approval from another Ethics Committee	
a) Will the research require approval by an ethics committee external to St Mary's University?	**NO**
b) Are you working with persons under 18 years of age or vulnerable adults?	**NO**

12) Identifiable risks	
a) Is there significant potential for physical or psychological discomfort, harm, stress or burden to participants?	**NO**
b) Are participants over 65 years of age?	**NO**
c) Do participants have limited ability to give voluntary consent? This could include cognitively impaired persons, prisoners, persons with a chronic physical or mental condition, or those who live in or are connected to an institutional environment.	**NO**
d) Are any invasive techniques involved? And/or the collection of body fluids or tissue?	**NO**

e) Is an extensive degree of exercise or physical exertion involved?	**YES**
f) Is there manipulation of cognitive or affective human responses which could cause stress or anxiety?	**NO**
g) Are drugs or other substances (including liquid and food additives) to be administered?	**NO**
h) Will deception of participants be used in a way which might cause distress, or might reasonably affect their willingness to participate in the research? For example, misleading participants on the purpose of the research, by giving them false information.	**NO**
i) Will highly personal, intimate or other private and confidential information be sought? For example, sexual preferences.	**NO**
j) Will payment be made to participants? This can include costs for expenses or time.	**NO**
k) Could the relationship between the researcher/ supervisor and the participant be such that a participant might feel pressurised to take part?	**NO**
l) Are you working under the remit of the Human Tissue Act 2004?	**NO**

13) Proposed start and completion date
Please indicate: • **When the study is due to commence.** • **Timetable for data collection.** • **The expected date of completion.** **Please ensure that your start date is at least 3 weeks after the submission deadline for the Ethics Sub-Committee meeting.**
Recruitment for the study will begin January 2017 after ethical approval.

It is anticipated that data collection will begin in January 2017 and be completed by the 14th March 2017. It is expected that the study will be completed by 14th April 2017.

14)Sponsors/Collaborators

Please give names and details of sponsors or collaborators on the project. This does not include your supervisor(s) or St Mary's University.

- **Sponsor: An individual or organisation who provides financial resources or some other support for a project.**
- **Collaborator: An individual or organisation who works on the project as a recognised contributor by providing advice, data or another form of support.**

N/A

15. Other Research Ethics Committee Approval

- **Please indicate whether additional approval is required or has already been obtained (e.g. the NHS Research Ethics Committee).**
- **Please also note which code of practice / professional body you have consulted for your project.**
- **Whether approval has previously been given for any element of this research by the University Ethics Sub-Committee.**

N/A

16. Purpose of the study

In lay language, please provide a brief introduction to the background and rationale for your study. [100 word limit]

- **Be clear about the concepts / factors / performances you will measure / assess/ observe and (if applicable), the context within which this will be done.**
- **Please state if there are likely to be any direct benefits, e.g. to participants, other groups or organisations.**

The sport of Gaelic Football (GF) is an intermittent field sport (McIntyre and Hall, 2004). GF players share similar physical and physiological characteristics as similar field sports players

such as Australian Football League (AFL) and Soccer (Gray and Jenkins, 2010; Watson, 1995). An important factor in match success is the player's ability to accelerate quickly over **short distances or undergo repeated sprints with limited recovery time while in and out of possession ((Florida-James and Reilly, 1995; Malone, Solan, Collins, and Doran, 2015).**

The importance of acceleration and high-intensity running within GF has been highlighted by Malone et al.,(2015) within a study of 50 elite GF players, the average total distances to be 8,160±1,482m, yet this is subject to change with positional demands from between 6183 ± 11104 m as outlined by Collins, Solan, and Doran (2013). Yet, more interestingly Malone et al., (2015) reported that players travelled 445±169m at spring speed (≥22km•h-**1) and underwent 184±40 accelerations per game and this equated to 2.6±0.5 accelerations per minute. This** research supports the view that player's ability to quickly accelerate is of vital importance within **successful GF performance.**

Repeated Sprint Ability (RSA) as described by Girard, Mendez-Villanueva, and Bishop (2011) as the ability to produce submaximal efforts (<10s) coupled with periods of low to moderate recovery couple with recovery of 60-300 seconds (s). As previously noted by Rampinini, Sassi, Morelli, Mazzoni, Fanchini, and Coutts (2009) improved RSA enables players to recovery more efficiently between bouts of high intensity activity such as acceleration and sprint activity.

The use of small sided games (SSGs) have long been researched within soccer as a method to improve performance, especially developing technical skills and improving maximal aerobic capacity (Gamble, 2013). Yet, the research of SSGs with GF is limited with a small number of recent studies investigating the physical and physiological effects of SSGs within the sports of GF (Malone et al.,2015; Malone, Solan, and Collins, 2016). Research within high-intensity intermittent running (HIIR) methods has shown that HIIR training programs with components of short interval bursts of >100% MAS with 10 sec. is an effective method in developing aerobic capacity while improving acceleration with field sports (Baker, 2011)

As of date, no research study has set to investigate the role of SSGs to improve acceleration and RSA within GF. Based on the previous analysis above, the purpose of this study is to investigate the effect of SSGs vs. HIIR training on improving acceleration and RSA within club GF players. It is hypothesised that the SSGs protocol will result in greater improvements in both acceleration and RSA results compared to the HIIR group.

It is suggested that benefits of the study includes both physical and educational training for the participants due to taking part in the study. It is proposed that the research study may aid in filling a void in current research and add valuable knowledge in the use of SSGs for on-field training, by offering valid and reliable training protocols.

References:

Baker, D. (2011). Recent trends in high-intensity aerobic training for field sports. Professional Strength & Conditioning**,** 22**, 3-8.**

Florida-James, G., & Reilly, T. (1995). The physiological demands of Gaelic football. British Journal of Sports Medicine**,** 29**(1), 41-45.**

Gamble, P. (2013). Strength and conditioning for team sports: sport-specific physical preparation for high performance**. Routledge.**

Girard, O., Mendez-Villanueva, A., & Bishop, D. (2011). Repeated-sprint ability—Part I. Sports medicine**,** 41**(8), 673-694.**

Gray, M. A. J., & Jenkins, D. G. (2010). Match analysis and the physiological demands of Australian football. Sports Medicine**,** 40**(4), 347-360.**

Malone, S., Solan, B., Collins, K., & Doran, D. (2015). The Positional Match Running Performance of Elite Gaelic Football. Journal of strength and conditioning research/National Strength & Conditioning Association**.**

Malone, S., Solan, B., & Collins, K. (2016). The Influence of pitch size on running performance during Gaelic football small sided games. International Journal of Performance Analysis in Sport**,** 16**(1), 111-121**

McIntyre, M. C., & Hall, M. (2004). Physiological profile in relation to playing position of elite college Gaelic footballers. British journal of sports medicine**,**39**(5), 264-266.**

Rampinini, E., Sassi, A., Morelli, A., Mazzoni, S., Fanchini, M., & Coutts, A. J. (2009). Repeated-sprint ability in professional and amateur soccer players. Applied Physiology, Nutrition, and Metabolism**,** 34**(6), 1048-1054.**

Watson, A. W. (1995). Physical and fitness characteristics of successful Gaelic footballers. British journal of sports medicine**,** 29**(4), 229-231.**

17. Study Design/Methodology

In lay language, please provide details of:

a) **The design of the study (qualitative/quantitative questionnaires etc.)**
b) **The proposed methods of data collection (what you will do, how you will do this and the nature of tests).**
c) **You should also include details regarding the requirement of the participant i.e. the extent of their commitment and the length of time they will be required to attend testing.**
d) **Please include details of where the testing will take place.**
e) **Please state whether the materials/procedures you are using are original, or the intellectual property of a third party. If the materials/procedures are original, please describe any pre-testing you have done or will do to ensure that they are effective.**

a) This research study proposes to recruit 32 senior male sub-elite Gaelic football (GF) players to be distributed into two intervention groups consisting of one small sided games and one high-intensity interval running group, both groups will conduct 20 on field intervention sessions over a 10 week period lasting 1 hr. per session including warm-up and cooldown. Prior to beginning the research study, participants are to conduct a health screening, body composition analysis and a maximal aerobic capacity ($\dot{V}O_2max$) test four days before the research study begins.

Participants are to be distributed between both intervention groups based on their aerobic fitness testing results, this will ensure both groups are of even cardiovascular fitness levels prior to the beginning of the research study. All participants are to attend a familiarisation session two days prior to the beginning of the research study and made familiar with both the acceleration and repeat sprint ability tests. All intervention sessions will be conducted at the same time of the day (7:00pm) and separated by 48 hours. The research study is to be conducted on a 3G artificial grass pitch with the dimensions of length 100m by 80 m width.

On intervention day, quantitative data will be collected from each participant using a Team polar (Polar, Finland) heart rate monitor. Each participant will complete a standardised warm up including the R.A.M.P. (Jeffries, 2007) and GAA 15 method for 15 minutes. On completion each participant will collect into their agreed research group and undergo their intervention session on the researcher's command.

Intervention methods consist of two groups, group 1; Small Sided Games (SSGs) consisting of 16 participants (4 v 4) undertaking a 6 x 4 minute (completed at 85-95% HRmax), with 3 min active recovery (completed at 50-60% HRmax) on an 80 x 20 m pitch as outlined by Collins, Doran & Reilly (2013). Group 2; High-Intensity Intermittent Running (HIIR) consisting of 16 participants will undergo a liner running protocol based on the maximal aerobic speed (Baker, 2011) method at 95% maximal heart rate (HRmax).Participants are to undergo a 1 kilometre (km) time trial to access their maximal aerobic speed (MAS) per meter per second (m/s). Once m/s per player is accessed, the researcher sets the distance between two cones at > 95% HRmax, to be covered by the player in 7 sec. as outlined in figure 1 with the players rounding

the cone and coming to a full stop before their next run. HIIR group have a work to rest ratio of 1:10 to allow for full ATP-PCr recovery, HIIR continues for 6 minutes with 3 minute recovery period as consistent with SSGs intervention method.

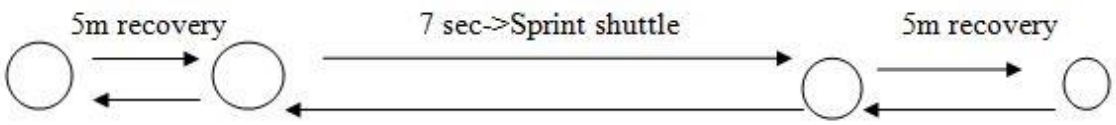

Figure 1: Diagram of HIIR shuttle

At the end of each 6 minute intervention block the researcher will collect both heart rate (H/R) and session rate of perceived exertion (s-RPE) form each participant as outlined by Impellizzeri et al,. (2004), this information will be taken a total of 6 times. Participants will undergo a standardised cool-down consisting on light jogging and static stretching to ensure the body returns to pre-training intensity levels. On completion of the 10 week intervention, players will be retested on body composition analysis, acceleration and repeat sprint ability using the same methods utilised in pre-intervention testing.

b) Prior to beginning the research study all participants are required to under a health screening consisting of successful completion of a Physical Activity Readiness Questionnaire (PAR-Q) and participant consent form. This is to be followed by the researcher taking the measurement of resting heart rate (HR) and blood pressure (BP) using an Omron M3 Intellisense Upper Arm Blood Pressure Monitor (Omron Healthcare Europe B.V. Hoofddrop, Netherlands). Blood pressure will be measured by placing the omron inflatable cuff on the left brachial artery of participants and results recorded as systolic over diastolic blood pressure. Body composition analysis players height using a Seca 213 Portable Stadiometer (Seca, Hamberg, Germany) measured to the nearest 0.1 centimetre (cm). Player weight was recorded using a Seca 803 weighing scale with results recorded to the nearest 0.1 kilogram (kg). Participants skinfold measurements are to be collected using the 3 site method of chest, abdominal and thigh using a Harpenden skinfold caliper (Baty International, West Sussex, United Kingdom) and body fat percentage calculated using the Jackson and Pollock equation as outlined by Cullen et al.**,(2013).**

Participants maximal aerobic capacity is to be investigated using the field sport specific Yo-Yo Intermittent Recovery test 1 (Bangsbosport.com, Denmark) as previously validated by Bangsbo et al,. (2008) (2008). (1994). This test involves participants to complete a sequence of 20 meter (m) shuttle runs coupled with a 5 m recovery zone, back and forth to the sound of an electronic beep. As the participant increase levels, this results in a quicker beep at a faster speed until either the player misses two beeps or fatigues and leaves the test. Maximal aerobic capacity is calculated using the Bangsbo et al.,**(2008) formula of YYIR1 (m) x 0.0084 +36.4 =**

$\dot{V}O_2$max. This information is to be used to place participants into either the SSG or HIIR group to ensure groups are of even cardiovascular levels before beginning the research.

Prior to undergoing the intervention, all participants are to have both acceleration and RSA tested. The location of testing will be conducted on an outdoor grass pitch, players acceleration is to accessed using a 10m linear sprint test as outlined by Little & Williams (2005) from a stationary start. Acceleration times are to be collected using the Brower Timing TC-System electronic timing gates (Brower timing systems, Draper, Utah, USA). Participants start position is on a line 2 m apart and the second gate (2 photocells) placed 10m in front, also with gates placed 2 m apart. Players undertake three attempts with 60 seconds recovery between bouts with the best sprint used for analysis. Participants are required to undergo RSA testing on a separate training session as not to have residual effect of the sprint test comprising RSA results.

The RSA testing protocol as offered by Rampinini et al., (2009) consisting of a linear grid of cone markers set at the starting line and opposite cones set a 20m distance. Participants are to complete 6 x 40m sprints, broken into two 20m sprints with the participant touching the 20m marker with their hand and returning to the start line for a 20 second passive recovery, once completed RSA was accessed by the best sprint time.

The HIIR groups will have their MAS calculated using a 1km time trial on a 400m athletic track. This continuous run is set of 1 km and the MAS calculated by distance(m)/completed time(s)=100% MAS. Each HIIR participant will have their MAS x 7 sec. (maximal acceleration time in GF) to calculate their HIIR distance. Both intervention groups are to calculate maximal training intensity using the HR reserve equation of Maximal heart rate= (HRmax – HR resting) × %Intensity) + HR resting. Resting HR is collected during the health screening process and HR and s-RPE collected as previously outlined. Post testing of both acceleration and RSA are to be completed at the end of week 10.

Once all pre-intervention testing is completed the researcher will begin his 10 week intervention protocol as described previously. On completion of intervention sessions, all participants will undergo a cool-down , to reduce the effects of the testing intensity of the body and bring the body back to a state of homeostasis using light movement and static stretching.

References

Baker, D. (2011). Recent trends in high-intensity aerobic training for field sports. Professional Strength & Conditioning**, 22, 3-8.**

Bangsbo, J. (1994) Energy demands in competitive soccer. Journal of Sports Sciences **12, 5-12.**

Bangsbo, J., Iaia, F. M., & Krustrup, P. (2008). The Yo-Yo intermittent recovery test. Sports medicine, 38**(1), 37-51.**

Collins, D. K., Solan, B., & Doran, D. (2013). A preliminary investigation into high-intensity activity in Gaelic football. J Sports Ther, 6**(3).**

Cullen, B. D., Cregg, C. J., Kelly, D. T., Hughes, S. M., Daly, P. G., & Moyna, N. M. (2013). Fitness profiling of elite level adolescent Gaelic football players. The Journal of Strength & Conditioning Research, 27**(8), 2096-2103.**

Impellizzeri, F. M., Rampinini, E., Coutts, A. J., Sassi, A., & Marcora, S. M. (2004). Use of RPE-based training load in soccer. Medicine and science in sports and exercise, 36**(6), 1042-1047.**

Little, T., & Williams, A. G. (2005). Specificity of acceleration, maximum speed, and agility in professional soccer players. The Journal of Strength & Conditioning Research, 19**(1), 76-78.**

Rampinini, E., Sassi, A., Morelli, A., Mazzoni, S., Fanchini, M., & Coutts, A. J. (2009). Repeated-sprint ability in professional and amateur soccer players. Applied Physiology, Nutrition, and Metabolism, 34**(6), 1048-1054.**

c) Participants are required to commit to a 12 week period, including ore and post intervention testing. Intervention period will consist of 10 weeks with two intervention sessions per week, each session consisting of 1 hour in duration including warm-up , intervention and cool down.

d) All research is to be conducted on a 3G artificial grass pitch with the dimensions of length 100m by 80 m width located at a Dublin based GAA club. The 1km time trial is to be conducted on an outdoor 400m athletics track located at a Dublin based sports centre.

e) Pre & post intervention testing and intervention protocols are based on previous research as listed above.

18. Participants

Please mention:

a) **The number of participants you are recruiting and why. For example, because of their specific age or sex.**
b) **How they will be recruited and chosen.**
c) **The inclusion/exclusion criteria.**
d) **For internet studies please clarify how you will verify the age of the participants.**
e) **If the research is taking place in a school or organisation then please include their written agreement for the research to be undertaken.**

a) 32 male club GF players are to be selected for this study, this is to have two even intervention groups of 16 participants. The SSGs group requires 4 teams of 4 participants. Players are to be part of the senior club football squad and all players are to be over 18 years old.

b) Participants are to be recruited by the researcher contacting Dublin based GAA clubs and presenting the research proposal to club administrators and club players using a poster presentation as attached in appendix A and meeting the inclusion/exclusion criteria as outlined below.

c) Participant inclusion and exclusion criteria.

Inclusion	Exclusion criteria
• Senior club Gaelic footballers.	• Physically inactive.
• Males, physically active and currently training a minimal of twice per week.	• Answered yes to any question on the PAR-Q form.
• Passed the health screening including PAR-Q.	• Under 18 years old.
• Between18-35 years old.	• Smoker.
• Non-smokers.	• Previous or current history of metabolic, musculoskeletal disease, viral or bacterial infections.
• No current musculoskeletal injury.	• Current musculoskeletal injury
• No history of metabolic, musculoskeletal disease, viral or bacterial infections.	

d) N/A

19. Consent

If you have any exclusion criteria, please ensure that your Consent Form and Participant Information Sheet clearly makes participants aware that their data may or may not be used.

a) Are there any incentives/pressures which may make it difficult for participants to refuse to take part? If so, explain and clarify why this needs to be done

b) Will any of the participants be from any of the following groups?

- **Children under 18**
- **Participants with learning disabilities**
- **Participants suffering from dementia**
- **Other vulnerable groups.**

c) If any of the above apply, does the researcher/investigator hold a current DBS certificate? A copy of the DBS must be supplied separately from the application.

d) How will consent be obtained? This includes consent from all necessary persons i.e. participants and parents.

a) No

b) No

c) N/A

d) The participants will be given an information sheet and will provide written consent as described in appendix B

20. Risks and benefits of research/ activity

a) Are there any potential risks or adverse effects (e.g. injury, pain, discomfort, distress, changes to lifestyle) associated with this study? If so please provide details, including information on how these will be minimised.

b) Please explain where the risks / effects may arise from (and why), so that it is clear why the risks / effects will be difficult to completely eliminate or minimise.

c) Does the study involve any invasive procedures? If so, please confirm that the researchers or collaborators have appropriate training and are competent to deliver these procedures. Please note that invasive procedures also include the use of deceptive procedures in order to obtain information.

d) Will individual/group interviews/questionnaires include anything that may be sensitive or upsetting? If so, please clarify why this information is necessary (and if applicable, any prior use of the questionnaire/interview).

e) Please describe how you would deal with any adverse reactions participants might experience. Discuss any adverse reaction that might occur and the actions that will be taken in response by you, your supervisor or some third party (explain why a third party is being used for this purpose).

f) Are there any benefits to the participant or for the organisation taking part in the research (e.g. gain knowledge of their fitness)?

a) Participants will experience a small degree of physical stress during the study due to the use of submaximal physical effort. Delayed onset of muscle soreness (DOMS) is expected to last between 12-24 hours after exercise and is a normal response to high effort exercise. Participants will undergo a structured cooldown to aid reduce DOMS at the end of each intervention session.
b) Risks may be from muscle soreness post intervention as outlined above, all intervention sessions will be supervised by the researcher.
c) No
d) No
e) No adverse reactions are expected as procedures have low risk; however, if they do occur, the researcher is a trained first aider and will have access to contact St. James Hospital, James Street. Dublin 8.

21. Confidentiality, privacy and data protection

a) What steps will be taken to ensure participants' confidentiality?

- **Please describe how data, particularly personal information, will be stored (all electronic** data must be stored on St Mary's University servers).
- **Consider how you will identify participants who request their data be withdrawn, such** that you can still maintain the confidentiality of theirs and others' data.

b) Describe how you will manage data using a data a management plan.

- **You should show how you plan to store the data securely and select the data that will be made publicly available once the project has ended.**
- **You should also show how you will take account of the relevant legislation including that relating data protection, freedom of information and intellectual property.**

c) Who will have access to the data? Please identify all persons who will have access to the data (normally yourself and your supervisor).

d) Will the data results include information which may identify people or places?

- **Explain what information will be identifiable.**
- **Whether the persons or places (e.g. organisations) are aware of this.**
- **Consent forms should state what information will be identifiable and any likely outputs which will use the information e.g. dissertations, theses and any future publications/presentations.**

a) All participant information will be safeguarded and remain confidential during and after the research project in line with the data protection act 1998. All data will be collected and stored electronically on St Mary's University **servers. All paper data will be locked in a cabinet in a locked office accessed only by the researcher and supervisor. All participants will have a code attached to their name only know to the researcher and supervisor, which can be used to identify data if it needs to be withdrawn. All data will be disposed securely after 5 years. Anyone who withdraws from the research project will have all information and data collected destroyed.**
b) All participants will have a number code attached to their name and this code will be how data will be selected and made public when the research project is finished. All data will

be collected and stored on a password-protected computer known only by the research group on St Mary's University servers. Data will be presente**d as group averages thus no allowing identification of individuals.**

c) Mark O`Connell and Dr Stephen Patterson

d) No

22. Feedback to participants

Please give details of how feedback will be given to participants:

- **As a minimum, it would normally be expected for feedback to be offered to participants in an acceptable to format, e.g. a summary of findings appropriately written.**
- **Please state whether you intend to provide feedback to any other individual(s) or organisation(s) and what form this would take.**

Feedback from this study will only be given in a summary of findings. Any individual data that can be provided on request will only relate to pre and post testing and will be provided in a comprehensive text.

The proposer recognises their responsibility in carrying out the project in accordance with the University's Ethical Guidelines and will ensure that any person(s) assisting in **the research/ teaching are also bound by these. The Ethics Sub-Committee must be notified of, and approve, any deviation from the information provided on this form.**

Signature of Proposer(s)	**Date:**
Signature of Supervisor (for student research projects)	**Date:**

Appendix 2

Participant information sheets

2.1 Research information poster

St Mary's University Twickenham London

Small Sided Games vs. High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in GAA football.

Mark O Connell
The School of Sport, Health & Applied Science.
St. Marys University,
Twickenham,
UK.

Introduction:

•Within field sports, players are required to undergo high bursts of activity, including sprinting. This outlines the importance for players to be able to recover quickly from bouts of repeated sprinting given short recovery periods, also know as repeat sprint ability (RSA) (Girard,Mendez-Villanueva & Bishop, 2011)

•Players ability to be the first to the ball has been noted as an important component of gaining possession. Within GAA football it was found that players completed184±40 accelerations per game and this equated to 2.6±0.5 accelerations per minute. (Malone and Collins, 2016)

•Small Sided Games (SSG) and High-Intensity Intermittent Running (HIIR) have been shown to improve both aerobic and anaerobic player qualities.

•Players with high aerobic and anaerobic fitness are important in the final 15 minutes of a match, the fitter the player the more chance they have of beating non-fit players in a match (Mohr et al, 2003).

•In summary, Players with high levels of aerobic & anaerobic fitness help win games.

Fig1.Example of a Running –based Anaerobic Sprint Test used to calculate RSA (Bishop et al, 2001).

What is involved?

•The research project will be conducted 2 times a week for a 10 week period from January-March 2016.

•Player data collection including height, weight, blood pressure and body fat % taking at the start and the end of the project.

•The players will conduct an aerobic, acceleration and repeat sprint ability tests at the start and end of the 10 week intervention.

•Players will be split into two groups:1) SSG, and 2) HIIR.

•Groups 1 & 2 will undergo bouts of activity for 6 min x 4 sets with 3 min recovery (overall 16 min. of effort).

•The researcher will conduct all testing at the clubs training ground twice a week,over a 10 week period.

•The researcher will conduct and record all data from the testing sessions.

Fig. 1, Example of a Small sided Games layout (GAA, 2016)

Practical outcome of research

•Interval training with high intensity workloads have being shown to improve aerobic capacity and maintain players fitness even after a 6 week period of maintenance training (Mohr et al, 2003).

• Small Sided Games also help players develop technical skills, including hand passing.

•High-intensity Intermittent Running helps develop high levels of aerobic and anaerobic fitness levels.

•Players with higher fitness levels maintain the benefits over a longer period of time in-season (Baker, 2011).

Contact details:

•If your team or club is interested in being involved in this research project, Please contact:
•Mark O'Connell BSc (Hons) c.s.c.s
•086-3742177 or mjirelandfitcamail.com for more information.

References:
Baker, D. (2011). Recommends in high-intensity aerobic training for field sports. Professional Strength & Conditioning, 22, 3-9.
Bishop, D., Spencer, M., Duffield, R., & Lawrence, S. (2001). The validity of a repeated sprint ability test. Journal of Science and Medicine in Sport, 4(1), 19-29.
Gaelic Athletic Association (November 2016). Small-Sided Games. Accessed from http://learning.gaa.ie/planner
Girard, O., Mendez-Villanueva, A., & Bishop, D. (2011). Repeated-sprint ability—Part I. Sports medicine, 41(8), 673-694.
Malone, S., & Collins, K. (2016). The effect of game design, goal type and player numbers on the physiological and physical demands of hurling specific small-sided games. The Journal of Strength & Conditioning Research.
Mohr, M., Krustrup, P., & Bangsbo, J. (2003). Match performance of high-standard soccer players with special reference to development of fatigue. Journal of sports sciences, 21(7), 519-528.

2.2 Participant Information sheet

St Mary's University Twickenham London

Participant Information sheet

Effect of Small-Sided Games Verses High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football.

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this:

What is the purpose and aim of our research?
Within competitive Gaelic football games, it is important for players to have the ability to accelerate quickly and repeat sprints within periods of short recovery, also known as repeat sprint ability. The aim of the study is to compare two on field training methods (small sided games and high-intensity intermittent running) on improvements in both acceleration and repeat sprint ability.

Why have I been invited?
You have been chosen because you are healthy male, who regularly undertakes exercise and is over the age of 18 and under the age of 35.

Who is organising the research?
The research is being organised by Mark O`Connell (MSc. student) and Dr Stephen Patterson (Senior Lecturer Exercise Physiology).

What will happen to the results of the study?
The results will be given within a "summary of findings" document after the study **is complete. You will only be given overall results and not the results of any other participant that took part. No further individuals or organisations will be given these findings.**

Source of funding for the research
There are no external sources of funding for this study.

Contact for further information
Mark O`Connell (145615@live.smuc.ac.uk)

Do I have to take part?

No, participation is by invitation only. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form and PAR-Q. You will be given copies of these. You are still free to withdraw at any time with no questions asked and no penalty.

What will happen if you agree to take part?
This study will involve two testing groups undertaking either small sided games (SSGs) or high-intensity intermittent running (HIIR). The SSGs group will be involved in a 4 vs. 4 game, while the HIIR groups will undergo maximal effort sprints to a set distance. Both groups will undertake 6 bouts of below maximal activity for 4 minutes with a 3 minute recovery in between.
You will be needed on a total of 23 intervention sessions. The visits will comprise of one familiarization session, a pre- and post testing session and 20 intervention sessions across 10 weeks to be conducted at Clann Na Gael Fontenoy GAA club. Every session will take 1 hour at the same time of day. Your weight, height and skinfold measurements will be taken and you will complete necessary questionnaires and consent forms before beginning the research study. Your familiarisation will include an outline of both the SSGs and HIIR methods. Per and post testing will include all participants undergoing an anaerobic fitness test, acceleration and repeat sprint ability tests. Only participants in the HIIR group will be required to undergo a 1 km time trial to assess maximal aerobic speed. Any final questions that you might have in regard to the procedures can be asked here or throughout the rest of the study. During the four experimental trials, you will follow the procedure provided below.

Whether there are any special precautions you must take before, during or after taking part in the study
Participants will be informed not to perform any vigorous exercise or consume any alcohol in the 24 h period before assessment.

On the day of the trial
The testing protocol will be the following the below structure;
Pre-testing warm-up; all participants undertake a 10-minute full body warm-up to increase blood flow, muscle temperature and mental readiness followed by the GAA 15 to aid in reducing incidence of injury during testing

Two testing protocols:
The two field testing methods used within this study are one Small sided games group and one high-intensity intermittent running group. Participants will break into their selected groups as instructed by the researcher.

Small sided games group:
Participants will play a small sided game of 4 vs. 4 on an 80 x 20-meter 3G artificial pitch for 4 minutes at high intensity followed by 3 minutes of low effort aerobic activity. This will be repeated 6 times also the researcher will collect both Heart rate and rate of perceived exhaustion data at the end of each high intensity bout.

High-intensity intermittent running group:
Each participant is assigned into a group that corresponds to their 100% maximal aerobic speed MAS, the participants run to their respective marker cones in 7 sec. rests for 70 sec. and repeats this protocol until the end of the 4 minutes, where you undergo 3 minutes of low intensity activity. This will be repeated 6 times also the researcher will collect both Heart rate and rate of perceived exhaustion data at the end of each high intensity bout

Cool down:

After field testing, all participants will undergo a cool-down protocol, to reduce the effects of the testing intensity of the body and bring the body back to a state of homeostasis using light movement and static stretching.

Post testing:
At the end of the study, participants will retest both field and body composition assessments to determine the most effective training method to improve acceleration and repeat sprint ability.

Are there any risks or side effects?
Any scientific investigate involving human participants carries an element of risk. You will be asked to undertake bouts of maximal effort during the testing. If you are not accustomed to high intensity interval training you may find this uncomfortable as you may get 'out of breath'. You will be fully supervised during all exercise, and will **be free to stop exercising whenever you wish. You may experience muscle soreness from the testing also known as delayed onset of muscle soreness (DOMS) due to muscular fatigue, this is normal and normally dissipates within 48 hours.**

Agreement to participate in this research should not compromise your legal rights if something goes wrong
Research can carry unforeseen risks and we want you to be informed of your rights in the unlikely event that any harm should occur as a result of taking part in this study. Every care will be taken to ensure that your well-being and safety are not compromised during the course of the study. St Marys University also has insurance arrangements in place in the unlikely event that something does go wrong and you are harmed as a result of taking part in the research study

What will happen to any information/data/samples that are collected from you?
Only the researchers will have access to the data collected during the study. However, your identity will not be revealed. All information which is collected about you during the course of the research will be kept strictly confidential. We will keep a record that you have taken part in the study but will not keep any other personal information about you. Professional standards of confidentiality will be adhered and the handling, processing, storage and destruction of data will be conducted in accordance with the Data Protection Act (1998).

Are there any benefits from taking part?
The participant may benefit from receiving individual feedback from data collected, and use the collected information to increase their education in their preparation for their sport. The participant may also benefit from increased aerobic capacity due to the protocols used and this may benefit their fitness levels.

How much time will I need to give up taking part in the project?
The total time commitment will be 23 hours over 13 weeks at Clann Na Gael Fontenoy GAA club

YOU WILL BE GIVEN A COPY OF THIS FORM TO KEEP TOGETHER WITH A COPY OF YOUR CONSENT FORM

2.3 Participant Consent form.

St Mary's University Twickenham London

NAME OF PARTICIPANT: _____

Title of the project: The effects of Small-Sided Games Verses High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football

Main investigator and contact details: Mark O`Connell (145615@live.smuc.ac.uk)

Members of the research team: Dr Stephen Patterson

1. I agree to take part in the above research. I have read the Participant Information Sheet which is attached to this form. I understand what my role will be in this research, and all my questions have been answered to my satisfaction.
2. I understand that I am free to withdraw from the research at any time, for any reason and without prejudice.
3. I have been informed that the confidentiality of the information I provide will be safeguarded.
4. I am free to ask any questions at any time before and during the study.
5. I have been provided with a copy of this form and the Participant Information Sheet.

Data Protection: I agree to the University processing personal data which I have supplied. I agree to the processing of such data for any purposes connected with the Research Project as outlined to me.

Name of participant
(print)……Signed……..…Date……

If you wish to withdraw from the research, please complete the form below and return to the main investigator named above.

I WISH TO WITHDRAW FROM THIS STUDY

Name: _____

Signed: _____ Date: _____

Appendix D; PAR-Q form.

2.4 PAR-Q form.

St Mary's University Twickenham London

St. Mary`s University, School of Sports, Health and Applied Sciences.
CONFIDENTIAL Medical History / Physical Activity Readiness Questionnaire (PAR-Q) FORM

This screening form must be used in conjunction with an agreed Consent Form.

Full Name: _____ **Date of Birth:** _____
Height (cm): _____ **Weight (kg):** _____

Have you ever suffered from any of the following medical conditions? If yes please give details:

	Yes	No	Details
Heart Disease or attack	☐	☐	
High or low blood pressure	☐	☐	
Chest pain during physical activity	☐	☐	
Bone or joint pain during Physical activity	☐	☐	
Asthma	☐	☐	
Diabetic	☐	☐	
Allergies	☐	☐	
Other, please give details	☐	☐	

Please give details of any medication you are currently taking or have taken regularly within the last year:

Please give details of any musculoskeletal injuries you have had in the past 12 months which have affected your capacity to exercise or caused you to take time off work or seek medical advice:

Other Important Information
During a typical week approximately how many hours/days would you spend exercising, and outline current exercise program?

If you drink alcohol please indicate how many units per week:

Are you currently taking any supplements or medication? Please give details:

Is there any reason not prompted above that would prevent you from participating within the relevant activity?

By signing this document I agree to inform the relevant individual(s) of any change(s) to my circumstances that would prevent me from participating in specific activities.

Signature (Participant): **Date:**

Signature (Test Coordinator*): **Date:**

***Test coordinator: The individual responsible for administering the test(s)/session**

2.5 Risk Assessment form.

St Mary's University Twickenham London

School of Sport, Health and Applied Science (SHAS)

PRACTICAL ACTIVITY RISK ASSESSMENT FORM

The following Risk Assessment template may be used by any individual intending to undertake a research or practice activity. This should be completed in combination with a relevant activity approval or Ethics Application form where relevant. Referring to appropriate sources of information, including the HSE website and University Health and Safety Policy Guidelines, the relevant activity coordinator must complete the fields below to adequately address the stages of managing hazards in any working environment.

Section 1 – Activity and Coordinator details:

Activity coordinator name:	**Marko O`Connell**	**Tutor / supervisor:**	**Dr. Stephen Patterson**
Phone number:	**00353863742177**	**Email address:**	**145615@live.smuc.ac.uk**
Activity title:	**The effects of Small-Sided Games versus High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football**		
Activity location(s) full details:	**Clanna Gael Fontenoy Gaelic Athletic Club (GAA), Sean Moore Park, Dublin 4, Rep. of Ireland**		

Outline of activity (please specify the type of activity being undertaken):	**No**	**Yes**	**If yes, please provide details:**
1. Use of Human Subjects: demographic type, requirements, age/young persons?		**X**	**Male, Age 18>35 years old, that meet the inclusion criteria.**
2. Use of an intervention (either solely or in combination) including dosage or application: E.g. ingestion of food, liquids or supplement, diet, massage, occlusion, environmental exposure, physical activity or other. Outline of specific dosage or application where relevant E.g. mg per kilo of body weight		**X**	**Research study is to use two intervention methods, one small sided games and one high-intensity intermittent running group. Participants undergo sub maximal intensity efforts for a period of 6 sets of 4 minutes activity with a recovery period of 3 minutes in between high intensity bouts. Heart rate and rate of perceived exertion (RPE) is collected by the researcher.**

3. Use of data and/or sample collection (solely or in combination): E.g. questionnaire/survey, human tissue sampling (blood / urine / saliva / sweat or other), respiratory analysis, body composition, performance tests or other.		x	Body composition assessment includes height and weight data is collected using a weighing scale and stradiometer, skinfold measurement taken on three sites using a skinfold caliper. Pre and post acceleration data is collected using electronic speed gates. During the testing sessions, each participant is fitted with a heart rate (HR) monitor. Both HR and RPE data is collected by the researcher during recovery periods within testing.
4. Use of chemicals/gas cylinders: Type(s), hazardous or not, MSDS available?	X		N/A
5. Equipment to be used:			
Brower timing TC-system, Team polar heart rate monitors, Seca weighing scales, stradiometer and Harpenden skinfold calipers.			

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SECTION 2: Risk Controls - For each hazard identified in Section 1, complete Section 2. Please refer to the Risk Assessment Guidance notes on simmsCAPital folder for Risk Matrix. Please note that L refers to Likelihood; S refers to Severity and RS refers to Risk Score (L times S equals RS)

	Outcome due to Hazard description (Substance / equipment / procedure)	Initial Risk Level High(13-25) Med (5-12) Low (0-4)	Necessary controls to eliminate or adequately reduce the Initial Risk Level of an associated hazard to a suitable Remaining risk level.	Remaining Risk Level High(13-25) Med (5-12) Low (0-4)
1	Access and usage of designated facility, site or location, including private or public.	High (20)	Permission received from board of management at facility and facility regularly inspected and regular maintenance carried out when required. The researcher is to inspect the facilities prior to each testing session and ensure a safe environment. All testing equipment is to be stored in a secure location by the researcher and inspected before each use. The researcher is a trained first aider and AED defibrillator qualified. An AED defibrillator and first aid kit will be present at each testing session.	Low (4)

2	Fire management and evacuation	Low (4)	Testing it to be conducted on field with no access to fire hazards. In case of emergency each participant is made aware of the pitch exits and designated emergency meeting location at facility.	Low (1)
3	Environmental exposure (internal and external) including temperature, humidity, lighting ventilation or relative weather conditions	High (13)	Participants are to be tested at the same location at the same time of day (7pm). Participants undergo a warm-up to increase body temperature before testing. Players are requested to wear thermal t-shirts/vest during evening testing. Participants will have rain jackets and tracksuits available if poor weather conditions exist.	Low (4)
4	Risks relating to layout , storage, space, obstructions including fall of objects, spillages, slips, trips & falls	High (16)	The researcher is to store all equipment in a secure location at the facility and inspect before each testing session. Maintain storage of all items in relevant cupboards / spaces. The researcher is to store all equipment in a designated safe area during on field during at least 10 meters away from participants. Spillage kits available and used immediately in the event of a spillage. Spillage signs available at location.	Low (3)
5	Manual handling, repetitive movements and working at heights	Med (5)	Only the researcher will handle testing equipment and is an experienced manual handler. Research equipment weights <5kg. No use of ladders is required within this study.	Low (2)
6	Use of Equipment including electrical	Low (4)	No electrical plugs or sockets are to be used in this study. Heart rate monitors are battery powered and comply with EU safety regulations. Pre-testing intervention tests are to use a rechargeable battery iPod and speaker and comply with EU safety regulations. Timing gates power is supplied using a rechargeable battery back and comply to US safety standards. Equipment inspected before the start of each session	Low (2)
7	Mechanical (machinery) and use of portable tools / equipment	Low (3)	The researcher will use a portable trundle wheel to set out field testing area and pre-testing using timing gates. The researcher has received adequate training use the equipment.	Low (1)

Health and Safety Risk Assessments – continuation sheet

SECTION 2: Risk Controls (continued) - For each hazard identified in Section 1, complete Section 2. Please refer to the Risk Assessment Guidance notes on simmsCAPital folder for Risk Matrix.

Please note that L refers to Likelihood; S refers to Severity and RS refers to Risk Score (L times S equals RS)

Hazard No.	Outcome due to Hazard description (Substance / equipment / procedure)	Initial Risk Level High (13-25) Med (5-12) Low (0-4)	Controls needed to eliminate or adequately reduce risks	Remaining Risk Level High(13-25) Med (5-12) Low (0-4)
8	Exposure to sharps – use of razors, lancets or other sharp object	Low (0)	N/A	Low (0)
9	Human subject physical activity, manipulation, treatment or other including use of equipment where relevant.	High (16)	The researcher is to ensure the participant is aware of the testing protocol and the associated risks (a written protocol is provided). Each participant has completed and signed an approved St Mary's Informed consent form and Par-Q prior to commencing any testing protocol. The researcher is to ensure each participant completes an appropriate warm-up prior to the testing session and cooldown to reduce the effects of delayed onset of muscle soreness (DOMS) from testing.	Low (4)
10	Exposure and reaction to use of food, drinks or supplements	Low (0)	N/A	Low (0)
11	Biological hazards	Low (0)	N/A	Low (0)
12	Working at heights	Low (0)	N/A	Low (0)
13	Lone working, including out of hours	Med (10)	The researcher is to undertake testing at 7pm on Tuesday and Thursday evenings and testing facility.	Low (4)
14	Use of chemicals	Low (0)	N/A	Low (0)
15	Other (Please specify and attach a copy of the relevant methodology with associated safety notes):	Low (0)	N/A	Low (0)

SECTION 3: Arrangement for supervision and/or monitoring effectiveness of control

Monitoring achieved through pre and post checks, continual test supervision and/or a separately recruited individual where further supervision or monitoring is required. Even where students demonstrate high levels of competency, regular checks should be made by supervising staff that should also be readily available to assist with any questions or problems students might have. Any practice should be amended or stopped if an emerging hazard dictates such a response. This option should be adopted where any uncertainty occurs, seeking advice from suitable staff.

SECTION 4: Referral guidelines relevant to the intended activity (scanned PDF of hard copy, listed web link or other source):

Information source	Location	Areas of information
Student Information Folder	MyModules	Student Research Approval Form
University Ethics Committee	Student portal	Ethics Application process and associated forms
University Health and Safety portal	Student portal	Health and Safety Policy guidelines including Risk Management, Manual lifting.
The Health and Safety Executive	Website found through any web search engine	Well-presented sources of legally approved regulation and legislation covering COSSH, CHIP, RIDDOR, DSE and many other areas of health and safety at work
Further discipline specific sources of information may be relevant to the area of activity including accreditation bodies such as BASES and UKSCA		

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SECTION 5: Emergency response procedures

In the event of an emerging incident, engage the individual(s) who have been previously agreed as responsible for addressing an emergency incident. Assess and eliminate (where safe) hazards that might place the individual(s) needing care or carer(s) at risk. Apply up to date first aid and/or seek medical assistance where appropriate. Contact the University security team for assistance with any incident on or off campus. Contact relevant staff (tutor, Technical team or other) where relevant. Complete relevant reporting form (accident, medical emergency or near miss) available to staff on the University H&S portal page, passing to the Technical Services team for processing. Complete HSE RIDDOR form where relevant, which can be found on the HSE website.

Important contact details (including where activities are undertaken off campus):

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- **St Mary's University Security – 0208 240 4335 or 4060 (advise in the event of calling the emergency services)**
- **St Mary's University main reception – 0208 240 4000**
- **Health and Safety Executive (HSE) Information line – 0845 345 0055 / www.HSE.gov.uk**
- **Clanna Gael Fontenoy GAA club house- +353 01 660 4064 / http://clannagaelfontenoy.ie/who-are-we/**
- **Emergency operator- 999**
- **St. James Hospital, Dublin- +353 01 410 3000 /http://www.stjames.ie**
- **Mark O`Connell- +353 86 3742177**

Please make note of any other relevant contacts here:

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SECTION 7: Period of cover – If a more complex assessment is required, continue below:

PERIOD OF COVER FOR TASK/EVENT		PRINT NAME OF TASK/EVENT LEADER(S)	SIGNATURE	DATE SIGNED	HAZARDS IDENTIFIED (mark with a tick or a cross)
FROM	TO				
		N/A			
		N/A			

SECTION 8: Student liability declaration:

By signing this risk assessment I confirm that I have read and understood the above information that is relevant to my activity, and will ensure adherence to appropriate practice at all times, based on completing formal competency training relevant to the activity I am planning to undertake. I understand that the above statements are intended to be generalised, being applicable to all forms of activity. Not all parts may apply to a specific activity, but it is my responsibility to outline any possible/further detail of necessary hazard management procedures as safety notes within the relevant activity methodology, as statements of intent within the associated Ethics Application Form and as associated Human Subject Consent Form and Information sheet.

SIGNATURE:		PRINT NAME:	Mark O`Connell	DATE COMPLETED:	14th December 2016

Appendix 3

Data collection sheets

3.1 Participant Pre-intervention data

*	Age	Hgt (cm)	Wgt (Kg)	B/P (mmHg)	Resting H/R (bpm)	Max H/R (bpm)	BF(avg)			BF%	1km TT (s)	MAS (m/s)	YO-YO IR1 (m)	Vo2 max (ml/kg-1 ml-1)	10 Acc (s)	RSA total (s)	RSA average (s)	FI (%)
							Pec	Abs	Quad									
1	21	182	80	136/87	77	199	14	10	12	9.9	267	3.75	1360	47.82	2.14	43.61	6.2	2.29
2	29	187.5	81.4	134/82	68	191	12	18	10	12.0	262	3.82	1400	48.16	2.46	47.36	6.8	2.84
3	19	175	64.5	124/85	83	201	10	10	12	8.5	270	4.16	1880	52.19	2.41	43.9	6.3	6.23
4	24	186	83	122/82	77	196	18	22	12	15.0	308	3.25	520	40.77	2.1	46.73	6.7	4.58
5	21	180	78.9	124/83	79	199	12	14	12	10.5	228	4.39	2240	55.22	2.27	48.17	6.9	4.17
6	29	192	87.1	125/87	70	191	12	18	16	13.8	280	3.57	1000	44.80	2.35	44.78	6.4	4.94
7	27	182	84	130/85	75	193	12	10	10	9.4	262	3.82	1400	48.16	2.17	43.32	6.2	1.46
8	26	175.5	70.4	117/79	79	194	12	20	12	12.9	270	3.7	1160	46.14	2.04	45.06	6.4	5.56
9	25	183	69	133/76	65	195	10	12	10	9.1	269	3.71	1240	46.82	2.15	43.98	6.3	2.91
10	27	175	87	129/87	82	193	14	16	10	11.8	275	3.63	1120	45.81	2.32	46.78	6.7	3.35
11	23	180	79	134/82	68	197	12	16	12	11.3	262	3.81	1380	47.99	2.19	43.47	6.2	2.61
12	25	180	75	126/85	77	195	12	22	12	13.4	235	4.25	2040	53.54	2.2	45.91	6.6	3.89
13	34	170	78	118/79	79	186	12	18	12	13.2	240	4.17	1920	52.53	2.09	43	6.1	2.13
14	29	177	84	124/85	83	191	16	16	12	13.2	240	4.17	1920	52.53	2.09	42.94	6.1	0.98
15	24	175	86	120/76	73	196	12	16	10	10.9	260	3.85	1440	48.50	2.46	47.33	6.8	3.15
16	28	177	82	122/82	77	192	12	18	12	12.5	252	4.05	1720	50.85	2.29	43.19	6.2	2.97
17	33	175	79	124/83	79	187	16	18	10	13.7	248	4.03	1720	50.85	1.94	42.17	6.0	3.01
18	23	179	83	130/82	75	197	12	16	10	10.7	280	3.57	1000	44.80	1.82	44.31	6.3	5.67
19	26	185	86	121/82	75	194	14	16	10	11.7	262	3.81	1360	47.82	2.35	43.58	6.2	5.24
20	25	178	84	121/82	65	195	16	18	8	12.2	239	4.18	1920	52.53	2.3	47.83	6.8	4.32
21	31	183	80	125/87	70	189	12	12	12	11.0	244	4.09	1800	51.52	2.31	44.09	6.3	3.55
22	28	188	80	130/85	75	192	12	12	12	10.7	247	4.05	1740	51.02	2.32	47.12	6.7	6.38
23	26	177	78	117/79	79	194	12	16	12	11.7	268	3.75	1280	47.15	2.27	46	6.6	5.73
24	26	180	90	133/76	65	194	10	18	16	12.9	255	3.93	1560	49.50	2.12	47.95	6.9	1.17
25	31	172	86	132/83	79	189	12	26	12	15.2	253	3.95	1560	49.50	2.42	46.81	6.7	4.74
26	25	170	78	136/87	77	195	8	12	8	7.8	267	3.75	1280	47.15	2.2	43.87	6.3	1.44
27	24	180	91	129/87	82	196	16	22	16	15.6	315	3.17	400	39.76	2.33	46.83	6.7	3.34
28	23	177	110	134/82	68	197	18	26	16	17.2	320	3.12	320	39.09	2.1	46.48	6.6	4.78
29	26	180	78	126/85	77	194	18	16	16	14.6	265	3.77	1320	47.49	2.17	43.52	6.2	5.61
30	20	170	75	118/79	79	200	20	22	10	14.5	270	3.7	1220	46.65	2.11	44.06	6.3	2.90
31	26	175.5	87	124/85	83	194	16	22	12	14.6	300	3.33	640	41.78	2.05	47.58	6.8	6.18
32	32	182	89	120/76	73	188	18	22	14	16.5	305	3.27	600	41.44	2.36	43.54	6.2	5.40
	26.1	179.0	82.0		75.4	193.9	13.5	17.2	11.9	12.4	266	3.80	1358	47.8	2.22	45.2	6.5	3.86
	3.7	5.3	7.9		5.5	3.7	2.9	4.4	2.2	2.3	23.1	0.3	487	4.1	0.2	1.8	0.3	1.58

Small-Sided Games (SSG`s)

n	Age	Hgt (cm)	Wgt (Kg)	B/P (mmHg)	Resting H/R (bpm)	Max H/R (bpm)	BF%	1km TT (sec)	MAS (m/s)	YO-YO IR1 (m)	Vo2 max (ml-kg-1-ml-1)	Best: Acc 10m (s)	RSA total sprint time (s)	RSA average sprint time(s)	FI (%)
1	34	170	78	118/79	79	186	13.2	240	4.17	1920	52.53	2.09	43	6.1	2.13
2	26	175.5	87	124/85	83	194	14.6	300	3.33	640	41.78	2.05	47.58	6.8	6.18
3	29	192	87.1	125/87	70	191	13.8	280	3.57	1000	44.80	3.35	44.78	6.4	4.94
4	28	177	82	122/82	77	192	12.5	252	4.05	1720	50.85	2.29	43.19	6.2	2.97
5	28	188	80	130/85	75	192	10.7	247	4.05	1740	51.02	2.32	47.12	6.7	6.38
6	25	180	75	126/85	77	195	13.4	235	4.25	2040	53.54	2.2	45.91	6.6	3.89
7	31	172	86	132/83	79	189	15.2	253	3.95	1560	49.50	2.42	46.81	6.7	4.74
8	23	177	110	134/82	68	197	17.2	320	3.12	320	39.09	2.1	46.48	6.6	4.78
9	26	175.5	70.4	117/79	79	194	12.8	270	3.7	1160	46.14	2.04	45.06	6.4	5.56
10	24	175	86	120/76	73	196	10.9	260	3.85	1440	48.50	2.46	47.33	6.8	3.15
11	31	183	80	125/87	70	189	11	244	4.09	1800	51.52	2.31	44.09	6.3	3.55
12	33	175	79	124/83	79	187	13.7	248	4.03	1720	50.85	1.94	42.17	6.0	3.01
13	26	180	90	133/76	65	194	12.9	255	3.93	1560	49.50	2.12	47.95	6.9	1.17
14	29	187.5	81.4	134/82	68	191	12.0	262	3.82	1400	48.16	2.46	47.36	6.8	2.84
15	23	186	83	122/82	77	196	15.0	308	3.25	520	40.77	2.1	46.73	6.7	4.58
16	20	170	75	118/79	79	200	14.5	270	3.7	1220	46.65	2.11	44.06	6.3	2.90
	27.3	179.0	83.1		74.0	192.7	13.3	265.3	3.8	1360.0	47.8	2.27	45.60	6.51	3.92
	3.9	6.7	8.9		5.2	3.8	1.7	25.0	0.3	513.5	4.3	0.33	1.85	0.26	1.46

High-Intensity Intermittent Running (HIIR)

n	Age	Hgt (cm)	Wgt (Kg)	B/P (mmHg)	Resting H/R (bpm)	Max H/R (bpm)	BF%	1km TT (sec)	MAS (m/s)	YO-YO IR1 (m)	Vo2 max (ml-kg-1-ml-1)	Best: Acc 10m (s)	RSA total sprint time (s)	RSA average sprint time(s)	FI (%)
1	32	182	89	120/76	73	188	16.5	305	3.27	600	41.44	2.36	43.54	6.2	5.40
2	26	177	78	117/79	70	194	11.7	268	3.75	1280	47.15	2.27	46	6.6	5.73
3	21	180	78.9	124/83	79	199	10.5	228	4.39	2240	55.22	2.27	48.17	6.9	4.17
4	19	175	64.5	124/85	83	201	8.5	270	4.16	1880	52.19	2.41	43.9	6.3	6.23
5	25	170	78	136/87	77	195	7.8	267	3.75	1280	47.15	2.2	43.87	6.3	1.44
6	26	185	86	121/82	75	194	11.7	262	3.81	1360	47.82	2.35	43.58	6.2	5.24
7	24	180	91	129/87	82	196	15.6	315	3.17	400	39.76	2.33	46.83	6.7	3.34
8	26	180	78	126/85	79	194	14.6	265	3.77	1320	47.49	2.17	43.52	6.2	5.61
9	27	175	87	129/87	82	193	11.8	275	3.63	1120	45.81	2.32	46.78	6.7	3.35
10	27	182	84	130/85	75	193	9.4	262	3.82	1400	48.16	2.17	43.32	6.2	1.46
11	23	179	83	130/82	75	197	10.7	280	3.57	1000	44.80	1.82	44.31	6.3	5.67
12	25	178	84	121/82	65	195	12.2	239	4.18	1920	52.53	2.3	47.83	6.8	4.32
13	23	180	79	134/82	68	197	11.3	262	3.81	1380	47.99	2.19	43.47	6.2	2.61
14	29	177	84	124/85	83	191	13.2	240	4.17	1920	52.53	2.09	42.94	6.1	0.98
15	25	183	69	133/76	65	195	9.1	269	3.71	1240	46.82	2.15	43.98	6.3	2.91
16	21	182	80	136/87	77	199	9.9	267	3.75	1360	47.82	2.14	43.61	6.2	2.29
	24.9	179.1	80.8		75.5	194.8	11.5	267.1	3.8	1356.3	47.8	2.22	44.73	6.39	3.80
	3.2	3.7	6.9		6.0	3.2	2.5	21.8	0.3	475.3	4.0	0.14	1.75	0.25	1.74

3.2 Participant Post-intervention data

n	Wgt (Kg)	BF(avg)			BF%	1km TT (s)	MAS (m/s)	YO-YO IR1 (m)	Vo2 max (ml-kg-1-ml-1)	Best: Acc 10m (s)	RSA total sprint time (s)	RSA average sprint time(s)	FI (%)
		Pec	Abs	Quad									
1	80	10	12	10	9.9	265	3.77	1320	47.49	2.11	43.42	6.20	6.05
2	79	10	14	10	10.2	258	3.88	1480	48.83	2.39	47.21	6.74	2.70
3	66	10	14	12	9.7	266	3.76	1310	47.40	2.21	49.04	7.01	11.70
4	79	16	16	12	12.7	304	3.29	600	41.44	2.25	49.67	7.10	4.76
5	76	10	12	10	8.7	222	4.50	560	41.10	2.35	49.95	7.14	7.49
6	91	12	14	12	11.4	272	3.68	1180	46.31	2.23	45.64	6.52	12.52
7	84	10	10	12	9.4	262	3.82	1400	48.16	2.23	50.48	7.21	1.96
8	71	12	16	10	11.1	266	3.76	1300	47.32	2.05	44.88	6.41	4.29
9	66	10	10	8	7.9	262	3.82	1400	48.16	2.11	43.78	6.25	2.60
10	85	12	12	12	10.6	269	3.72	1240	46.82	2.28	46.35	6.62	3.98
11	77	12	14	10	10.1	258	3.88	1488	48.90	2.15	43.33	6.19	2.45
12	77	12	18	10	11.6	232	4.31	2120	54.21	2.24	51.53	7.36	4.97
13	76	10	14	12	10.7	248	4.03	1700	50.68	2.07	49.75	7.11	4.61
14	86	14	14	10	11.4	236	4.24	2020	53.37	2.08	42.78	6.11	0.98
15	83	12	12	8	9.0	236	4.24	2020	53.37	2.35	39.99	6.67	3.04
16	78	12	14	8	10.1	248	4.03	1700	50.68	2.27	43.09	6.16	2.81
17	81	14	14	10	11.9	248	4.03	1700	50.68	1.90	42.48	6.07	2.00
18	81	12	14	10	10.3	278	3.60	1060	45.30	1.95	43.99	6.28	4.85
19	86	12	16	8	10.5	260	3.85	1440	48.50	2.18	43.42	6.20	4.91
20	81	14	14	12	11.6	228	4.39	2240	55.22	2.29	45.99	6.57	5.42
21	81	12	10	12	10.4	240	4.17	1920	52.53	2.31	44.09	6.30	3.55
22	78	10	12	8	8.8	243	4.12	1840	51.86	2.30	47.24	6.75	5.62
23	76	12	14	10	10.5	253	3.95	1580	49.67	2.18	45.89	6.56	6.25
24	89	12	16	12	11.7	252	3.97	1620	50.01	2.10	47.67	6.81	3.13
25	85	12	16	12	12.2	249	4.02	1700	50.68	2.09	51.58	7.37	5.00
26	79	10	12	8	7.9	261	3.83	1420	48.33	2.16	43.81	6.26	1.28
27	90	14	20	12	13.2	305	3.28	580	41.27	2.21	46.5	6.64	3.69
28	100	16	22	12	14.3	305	3.28	580	41.27	2.09	46.3	6.61	2.92
29	75	16	14	10	11.7	260	3.85	1440	48.50	2.15	43.32	6.19	4.63
30	72	14	16	10	11.0	261	3.83	1420	48.33	2.15	37.65	6.28	1.92
31	84	14	16	10	11.7	291	3.44	1420	48.33	2.06	46.71	6.67	4.60
32	85	14	16	12	12.9	292	3.42	800	43.12	2.25	44.3	6.33	4.53
mean=	80.5	12.3	14.3	10.4	10.8	260.3	3.9	1425	48.4	2.18	45.68	6.58	4.41
sd=	7.0	1.9	2.6	1.5	1.5	21.5	0.3	445.8	3.7	0.11	3.23	0.39	2.53

Small-Sided Games (SSG`s)

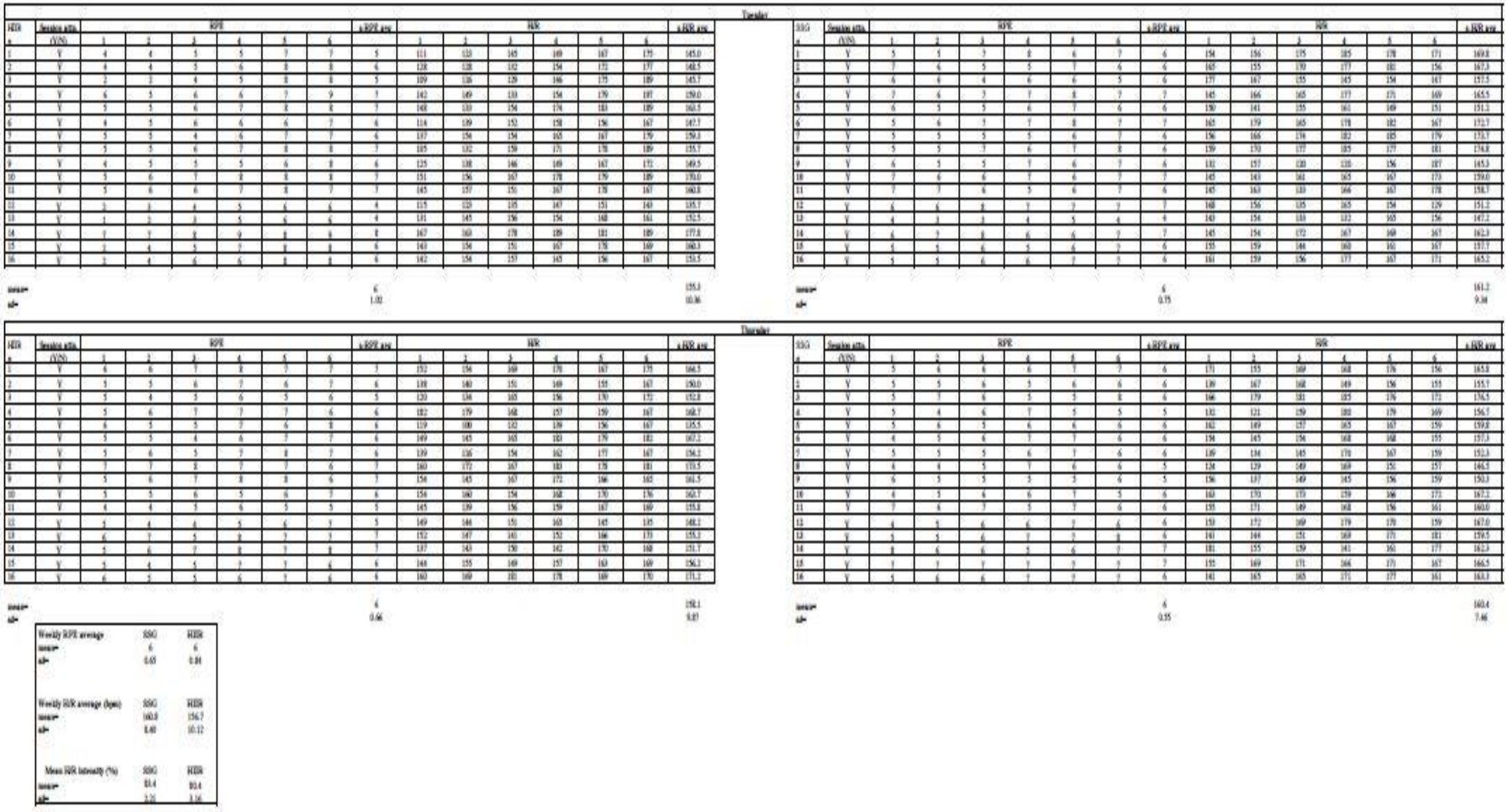
n	Wgt (Kg)	BF%	1km TT (sec)	MAS (m/s)	YO-YO IR1 (m)	Vo2 max (ml·kg-1·ml-1)	Best:Acc 10m (sec)	RSA total sprint time (s)	RSA average sprint time(s)	FI (%)
1	76	10.7	248	4.03	1700	50.68	2.07	49.75	7.11	4.61
2	84	11.7	291	3.44	1420	48.33	2.06	46.71	6.67	4.60
3	91	11.4	272	3.68	1180	46.31	2.23	45.64	6.52	12.52
4	78	10.1	248	4.03	1700	50.68	2.27	43.09	6.16	2.81
5	78	8.8	243	4.12	1840	51.86	2.30	47.24	6.75	5.62
6	77	11.6	232	4.31	2120	54.21	2.24	51.53	7.36	4.97
7	85	12.2	249	4.02	1700	50.68	2.09	51.58	7.37	5.00
8	100	14.3	305	3.28	580	41.27	2.09	46.3	6.61	2.92
9	71	11.1	266	3.76	1300	47.32	2.05	44.88	6.41	4.29
10	83	9.0	236	4.24	2020	53.37	2.35	39.99	6.67	3.04
11	81	10.4	240	4.17	1920	52.53	2.31	44.09	6.30	3.55
12	81	11.9	248	4.03	1700	50.68	1.90	42.48	6.07	2.00
13	89	11.7	252	3.97	1620	50.01	2.10	47.67	6.81	3.13
14	79	10.2	258	3.88	1480	48.83	2.39	47.21	6.74	2.70
15	79	12.7	304	3.29	600	41.44	2.25	49.67	7.10	4.76
16	72	11.0	261	3.83	1420	48.33	2.15	37.65	6.28	1.92
mean=	81.5	11.2	259.6	3.9	1518.8	49.2	2.18	45.97	6.68	4.28
sd=	7.3	1.4	22.8	0.3	441.8	3.7	0.13	3.89	0.40	2.47

High-Intensity Intermittent Running (HIIR)

n	Wgt (Kg)	BF%	1km TT (sec)	MAS (m/s)	YO-YO IR1 (m)	Vo2 max (ml-kg-1-ml-1)	Best: Acc 10m (sec)	RSA total sprint time (s)	RSA average sprint time(s)	FI (%)
1	85	12.9	292	3.42	800	43.12	2.25	44.3	6.33	4.53
2	76	10.5	253	3.95	1580	49.67	2.18	45.89	6.56	6.25
3	76	8.7	222	4.50	560	41.10	2.35	49.95	7.14	7.49
4	66	9.7	266	3.76	1310	47.40	2.21	49.04	7.01	11.70
5	79	7.9	261	3.83	1420	48.33	2.16	43.81	6.26	1.28
6	86	10.5	260	3.85	1440	48.50	2.18	43.42	6.20	4.91
7	90	13.2	305	3.28	580	41.27	2.21	46.5	6.64	3.69
8	75	11.7	260	3.85	1440	48.50	2.15	43.32	6.19	4.63
9	85	10.6	269	3.72	1240	46.82	2.28	46.35	6.62	3.98
10	84	9.4	262	3.82	1400	48.16	2.23	50.48	7.21	1.96
11	81	10.3	278	3.60	1060	45.30	1.95	43.99	6.28	4.85
12	81	11.6	228	4.39	2240	55.22	2.29	45.99	6.57	5.42
13	77	10.1	258	3.88	1488	48.90	2.15	43.33	6.19	2.45
14	86	11.4	236	4.24	2020	53.37	2.08	42.78	6.11	0.98
15	66	7.9	262	3.82	1400	48.16	2.11	43.78	6.25	2.60
16	80	9.9	265	3.77	1320	47.49	2.11	43.42	6.20	6.05
mean=	79.6	10.4	261.1	3.9	1331.1	47.6	2.18	45.40	6.49	4.55
sd=	6.8	1.5	21.0	0.3	443.6	3.7	0.09	2.51	0.36	2.65

3.3 Weekly Herat Rate and s-RPE data sheets

3.3.1 Week 1



Tuesday

HRR	Session nRPE	RPE							HR							
n	(Y/N)	1	2	3	4	5	6	x RPE ave	1	2	3	4	5	6	x HR ave
1	Y	4	4	5	5	7	7	5	111	133	145	169	167	175	145.0
2	Y	4	4	5	6	8	8	6	128	128	152	154	172	177	148.5
3	Y	2	2	4	5	8	8	5	109	126	129	146	175	189	145.7
4	Y	6	5	6	6	7	9	7	142	149	133	154	179	197	159.0
5	Y	5	5	6	7	8	8	7	148	133	154	174	183	189	160.5
6	Y	4	5	6	6	6	7	6	114	139	152	158	156	167	147.7
7	Y	5	5	4	6	7	7	6	137	156	154	165	167	179	159.3
8	Y	5	5	6	7	8	8	7	105	132	159	171	178	189	155.7
9	Y	4	5	5	5	6	8	6	125	138	146	149	167	172	149.5
10	Y	5	6	7	8	8	8	7	151	156	167	178	179	189	170.0
11	Y	5	6	6	7	8	7	7	145	157	151	167	178	167	160.8
12	Y	3	3	4	5	6	6	4	115	123	135	147	151	143	135.7
13	Y	3	3	3	5	6	6	4	131	145	156	154	168	161	152.5
14	Y	7	7	8	9	8	8	8	167	168	178	189	181	189	177.8
15	Y	3	4	5	7	8	8	6	143	154	151	167	178	169	160.3
16	Y	3	4	6	6	8	8	6	142	154	157	145	156	167	153.5
mean=								6							155.1
sd=								1.32							10.86

SSG	Session nRPE	RPE							HR							
n	(Y/N)	1	2	3	4	5	6	x RPE ave	1	2	3	4	5	6	x HR ave
1	Y	5	5	7	8	6	7	6	154	156	175	185	178	171	169.8
2	Y	7	6	5	5	7	6	6	165	155	170	177	181	156	167.3
3	Y	6	6	6	6	6	5	6	177	167	155	145	158	167	157.5
4	Y	7	6	7	7	8	7	7	145	166	165	177	171	169	165.5
5	Y	6	5	5	6	7	6	6	150	141	155	161	149	151	151.3
6	Y	5	6	7	7	8	7	7	165	179	165	178	182	167	172.7
7	Y	5	5	5	5	6	7	6	156	166	174	182	185	179	173.7
8	Y	5	5	7	6	7	8	6	159	170	177	185	177	181	174.8
9	Y	6	5	5	7	6	7	6	131	157	120	110	156	187	145.3
10	Y	7	6	6	7	6	7	7	145	143	161	165	167	173	159.0
11	Y	7	7	6	5	6	7	6	145	163	133	166	167	178	158.7
12	Y	6	6	8	7	7	7	7	168	156	135	165	156	129	151.2
13	Y	4	3	3	4	5	4	4	143	154	133	132	165	156	147.2
14	Y	6	7	8	6	6	7	7	145	154	172	167	169	167	162.3
15	Y	5	5	6	5	6	7	6	155	159	144	160	161	167	157.7
16	Y	5	5	6	6	7	7	6	161	159	156	177	167	171	165.2
mean=								6							161.2
sd=								0.75							9.84

Thursday

HRR	Session nRPE	RPE							HR							
n	(Y/N)	1	2	3	4	5	6	x RPE ave	1	2	3	4	5	6	x HR ave
1	Y	6	6	7	8	7	7	7	152	154	169	170	167	175	166.5
2	Y	5	5	6	7	6	7	6	138	140	151	169	155	167	150.0
3	Y	5	4	5	6	5	6	5	120	138	165	156	170	172	152.8
4	Y	5	6	7	7	7	6	6	122	129	148	157	159	167	168.7
5	Y	6	5	5	7	6	8	6	129	100	132	139	156	167	135.5
6	Y	5	5	4	6	7	7	6	149	145	165	183	179	181	167.2
7	Y	5	6	5	7	8	7	6	139	136	156	162	177	167	156.2
8	Y	7	7	8	7	7	6	7	160	172	167	183	178	181	171.5
9	Y	5	6	7	8	8	6	7	158	145	167	172	166	165	161.5
10	Y	5	5	6	5	6	7	6	156	160	154	168	170	176	160.7
11	Y	4	4	5	6	5	5	5	145	139	156	159	167	169	155.8
12	Y	5	4	4	5	6	5	5	149	144	151	165	145	135	148.1
13	Y	6	7	5	8	7	7	7	152	147	161	152	166	173	155.3
14	Y	5	6	7	8	7	8	7	137	143	150	162	170	160	151.7
15	Y	5	4	5	7	7	6	6	148	155	169	157	163	169	156.1
16	Y	6	5	5	6	7	6	6	160	169	181	178	169	170	171.2
mean=								6							158.1
sd=								0.66							8.87

SSG	Session nRPE	RPE							HR							
n	(Y/N)	1	2	3	4	5	6	x RPE ave	1	2	3	4	5	6	x HR ave
1	Y	5	6	6	6	7	7	6	171	155	169	168	176	156	165.8
2	Y	5	5	6	5	6	6	6	139	167	168	149	156	155	155.7
3	Y	5	7	6	5	5	8	6	166	179	181	185	176	172	176.5
4	Y	5	4	6	7	5	5	5	132	121	159	180	179	169	156.7
5	Y	5	6	5	6	6	6	6	162	149	157	165	167	159	159.8
6	Y	6	5	6	7	7	6	6	154	145	156	168	168	155	157.3
7	Y	5	5	5	6	7	6	6	139	134	145	170	167	159	152.3
8	Y	6	6	5	7	6	6	5	134	129	149	169	152	157	146.5
9	Y	6	5	5	5	5	6	5	156	137	149	145	156	159	150.1
10	Y	6	5	6	6	7	5	6	163	170	173	179	166	171	167.2
11	Y	7	6	7	5	7	6	6	155	171	149	168	156	161	160.0
12	Y	6	5	6	6	7	6	6	153	172	169	179	170	159	167.0
13	Y	5	5	6	7	7	8	6	141	164	151	169	171	181	159.5
14	Y	8	6	6	5	6	7	7	181	155	159	161	161	177	162.3
15	Y	7	7	7	7	7	7	7	155	169	171	166	171	167	166.5
16	Y	5	6	6	7	7	7	6	141	165	165	171	177	161	163.3
mean=								6							160.4
sd=								0.55							7.46

Weekly RPE average	SSG	HRR
mean=	6	6
sd=	0.65	0.81
Weekly HR average (bpm)	SSG	HRR
mean=	160.8	156.7
sd=	8.48	10.12
Mean HR intensity (%)	SSG	HRR
mean=	83.4	80.4
sd=	3.26	3.16

3.3.2 Week 2

Tuesday

HIIT	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	5	5	5	7	7	6	151	165	172	165	177	167	166.1
2	Y	4	4	5	6	8	8	6	161	145	189	167	159	172	167.2
3	Y	3	4	4	5	8	8	5	149	150	146	167	178	189	163.3
4	Y	6	5	6	6	7	8	6	155	161	153	167	170	169	162.5
5	Y	5	5	6	7	8	8	7	141	158	167	170	170	167	161.5
6	Y	4	6	6	6	6	7	6	156	145	169	167	184	159	163.3
7	Y	5	5	4	6	7	8	6	110	180	152	145	148	157	157.0
8	Y	5	5	6	7	8	7	6	123	165	161	156	177	176	159.7
9	Y	4	5	5	5	6	8	6	139	141	158	154	155	159	151.0
10	Y	5	6	7	8	7	8	7	134	145	169	167	168	179	157.0
11	Y	5	6	6	7	8	7	7	110	156	178	178	183	169	161.0
12	Y	3	5	4	5	6	6	5	145	159	167	178	167	165	163.5
13	Y	3	3	3	5	6	6	4	159	167	179	182	184	156	154.5
14	Y	7	7	8	9	8	9	8	156	176	169	178	176	184	173.1
15	Y	3	5	5	7	8	8	6	167	179	188	179	167	164	174.0
16	Y	4	4	7	7	8	8	6	145	156	188	158	167	171	155.3
mean=								6							160.6
sd=								0.94							8.87

SSG	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	7	6	6	8	8	7	7	134	164	166	182	179	181	134.5
2	Y	7	6	5	7	6	7	6	165	159	146	167	167	178	157.0
3	Y	8	6	5	8	8	7	7	154	149	167	179	187	181	169.5
4	Y	8	6	6	7	6	7	7	162	180	151	156	189	178	169.1
5	Y	7	8	5	7	7	6	6	160	172	166	176	181	175	168.3
6	Y	7	8	6	7	6	5	7	147	155	163	169	174	175	163.8
7	Y	7	5	5	6	7	6	6	157	167	172	182	178	177	172.3
8	Y	7	7	7	8	7	6	7	130	150	171	153	161	178	157.2
9	Y	6	6	6	7	6	6	6	139	149	159	155	169	169	156.7
10	Y	5	6	5	6	6	5	5	155	152	138	145	153	171	150.8
11	Y	8	6	7	7	6	7	7	151	167	179	158	169	178	167.3
12	Y	6	5	6	6	5	6	6	147	149	160	151	169	159	156.3
13	Y	7	6	7	6	5	6	6	150	169	167	159	196	159	161.7
14	Y	6	6	5	6	7	5	6	141	149	167	171	159	179	158.0
15	Y	7	6	7	7	6	7	7	161	150	171	167	177	180	167.8
16	Y	5	7	5	6	5	5	6	152	161	178	169	178	169	167.8
mean=								6							163.3
sd=								0.78							6.84

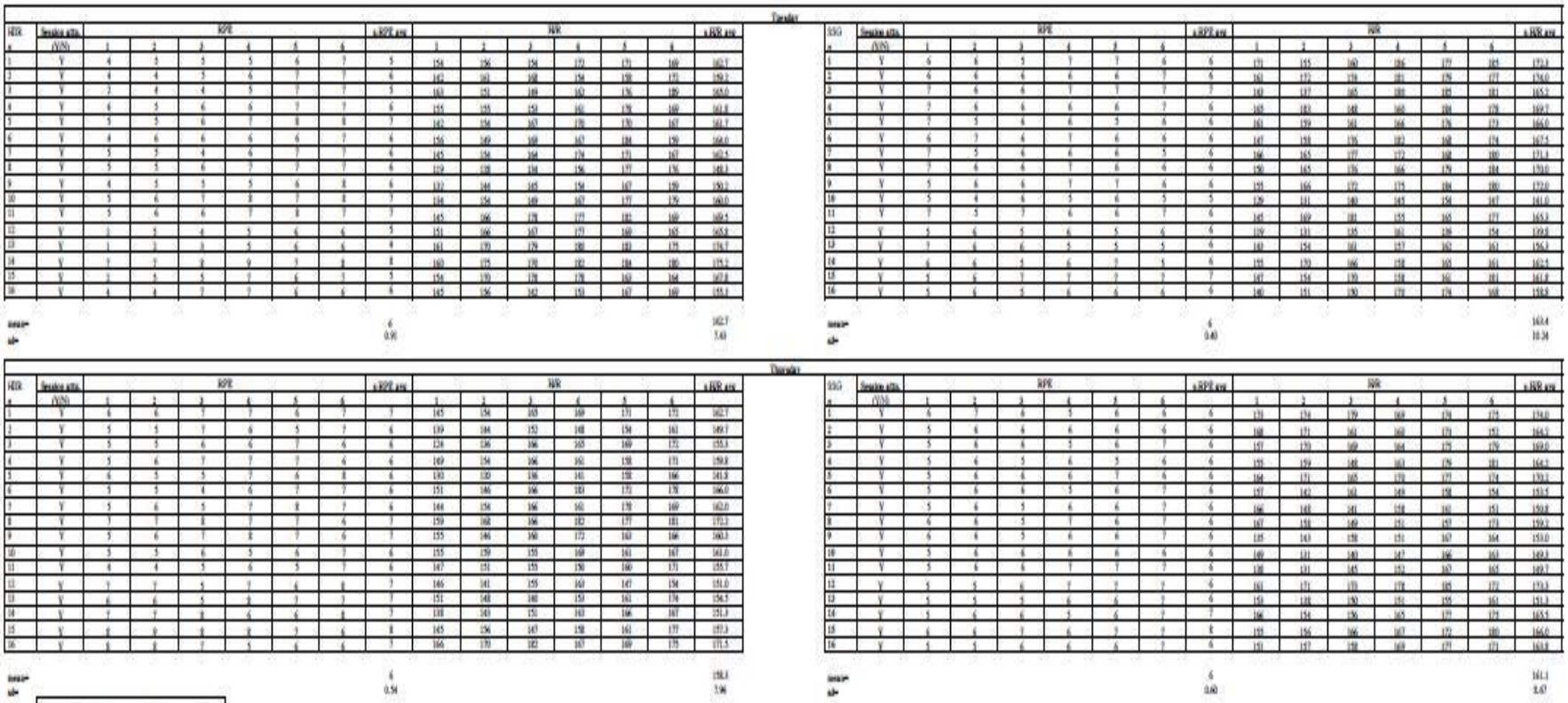
Thursday

HIIT	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	6	7	8	7	7	7	152	154	169	170	167	175	166.5
2	Y	5	5	6	7	6	7	6	138	160	151	169	155	167	150.0
3	Y	5	4	5	6	5	6	5	154	145	165	156	170	172	160.3
4	Y	5	6	7	7	7	6	6	132	179	168	157	159	167	168.7
5	Y	6	5	5	7	6	8	6	134	146	157	156	156	167	152.7
6	Y	5	5	4	6	7	7	6	149	168	165	183	179	182	171.0
7	Y	5	6	5	7	8	7	6	139	126	154	162	177	167	154.2
8	Y	7	7	8	7	7	6	7	160	172	167	183	178	181	173.5
9	Y	5	6	7	8	8	6	7	154	162	167	172	166	165	164.3
10	Y	5	5	6	5	6	7	6	154	160	154	168	170	176	163.7
11	Y	4	4	5	6	5	5	5	145	139	156	159	167	169	155.8
12	Y	3	3	5	3	6	3	3	149	168	151	165	145	135	148.2
13	Y	6	6	5	8	3	3	5	152	147	181	152	186	173	155.2
14	Y	8	8	8	6	6	8	7	145	140	150	162	170	168	150.0
15	Y	9	9	9	9	7	6	8	144	155	169	157	163	169	156.2
16	Y	8	8	7	5	6	6	7	160	169	181	178	169	170	171.2
mean=								6							160.1
sd=								0.79							8.11

SSG	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	5	6	6	7	7	7	167	166	171	176	167	172	169.8
2	Y	5	6	6	5	7	6	6	169	170	159	167	172	181	169.7
3	Y	6	7	6	5	7	8	7	169	168	157	165	181	177	166.2
4	Y	5	6	6	7	5	7	6	151	158	169	169	173	180	164.0
5	Y	5	6	5	6	6	6	6	155	166	170	177	182	172	170.8
6	Y	6	5	6	5	6	6	5	159	141	160	155	168	178	160.2
7	Y	5	5	5	6	7	6	6	160	149	159	156	168	169	160.8
8	Y	6	6	5	7	6	6	6	167	159	150	169	156	172	158.8
9	Y	6	5	5	5	5	6	5	169	165	156	168	177	179	169.0
10	Y	6	5	6	6	7	5	6	168	159	161	166	165	156	167.5
11	Y	7	7	7	8	7	7	7	159	159	162	168	166	165	165.2
12	Y	6	5	6	8	5	8	6	165	159	156	156	167	166	152.8
13	Y	5	5	6	7	7	8	6	152	144	169	178	196	179	158.0
14	Y	8	6	6	5	6	7	7	168	171	163	171	196	174	168.5
15	Y	6	7	7	7	7	8	8	155	161	158	167	177	187	167.5
16	Y	5	6	6	7	7	7	6	152	161	157	162	170	169	162.0
mean=								6							161.4
sd=								0.72							8.26

	SSG	HIIT
Weekly RPE average		
mean=	6	6
sd=	0.75	0.86
Weekly HR average (bpm)	SSG	HIIT
mean=	162.1	160.4
sd=	7.55	8.09
Mean HR Intensity (%)	SSG	HIIT
mean=	84.2	82.3
sd=	3.98	3.8

3.3.3 Week 3



Tuesday

HRR	Session nRPE	RPE						s-RPE avg	HR						s-HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	5	5	5	6	7	5	154	156	154	172	171	169	162.7
2	Y	4	4	5	6	7	7	6	142	161	168	154	158	171	159.2
3	Y	2	4	4	5	7	7	5	163	151	169	162	176	189	165.0
4	Y	6	5	6	6	7	7	6	155	155	152	161	178	169	161.8
5	Y	5	5	6	7	8	8	7	142	154	167	178	170	167	161.7
6	Y	4	6	6	6	6	7	6	156	169	169	167	184	159	166.0
7	Y	5	5	4	6	7	7	6	145	154	164	174	171	167	162.5
8	Y	5	5	6	7	7	7	6	119	128	138	156	177	176	148.3
9	Y	4	5	5	5	6	8	6	132	144	165	154	167	159	150.2
10	Y	5	6	7	8	7	8	7	134	154	169	167	177	179	160.0
11	Y	5	6	6	7	8	7	7	145	166	178	177	182	169	169.5
12	Y	3	5	4	5	6	6	5	151	166	167	173	169	163	165.0
13	Y	3	3	3	5	6	6	4	161	170	179	180	183	175	174.7
14	Y	7	7	9	9	9	8	8	160	175	178	182	184	180	175.2
15	Y	3	5	5	7	6	7	5	154	170	178	178	163	164	167.8
16	Y	4	4	7	7	6	6	6	145	156	162	153	167	160	155.1
mean=								6							162.7
s.d=								0.91							7.43

SSG	Session nRPE	RPE						s-RPE avg	HR						s-HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	6	5	7	7	6	6	171	155	160	186	177	165	172.1
2	Y	6	6	6	6	6	7	6	161	172	178	181	179	177	174.0
3	Y	7	6	6	7	7	7	7	183	177	165	188	195	181	165.2
4	Y	7	6	6	6	6	7	6	165	183	168	160	184	178	169.7
5	Y	7	5	6	6	5	6	6	161	159	161	166	176	173	166.0
6	Y	6	7	6	7	6	6	6	147	158	176	182	168	174	167.5
7	Y	7	5	6	6	6	5	6	166	165	177	172	168	180	171.3
8	Y	7	6	6	7	6	6	6	150	165	176	166	179	184	170.0
9	Y	5	6	6	7	7	6	6	155	166	172	175	184	180	172.0
10	Y	5	4	6	5	6	5	5	129	131	140	145	154	167	141.0
11	Y	7	5	7	6	6	7	6	145	169	181	155	165	177	165.3
12	Y	5	6	5	6	5	6	6	119	131	135	161	139	154	139.8
13	Y	7	6	6	5	5	5	6	143	154	161	157	162	161	156.3
14	Y	6	6	5	6	7	5	6	155	170	166	158	165	161	162.5
15	Y	5	6	7	7	7	7	7	147	154	170	158	161	181	161.9
16	Y	5	6	5	6	6	6	6	140	151	150	170	174	168	158.8
mean=								6							163.4
s.d=								0.40							10.34

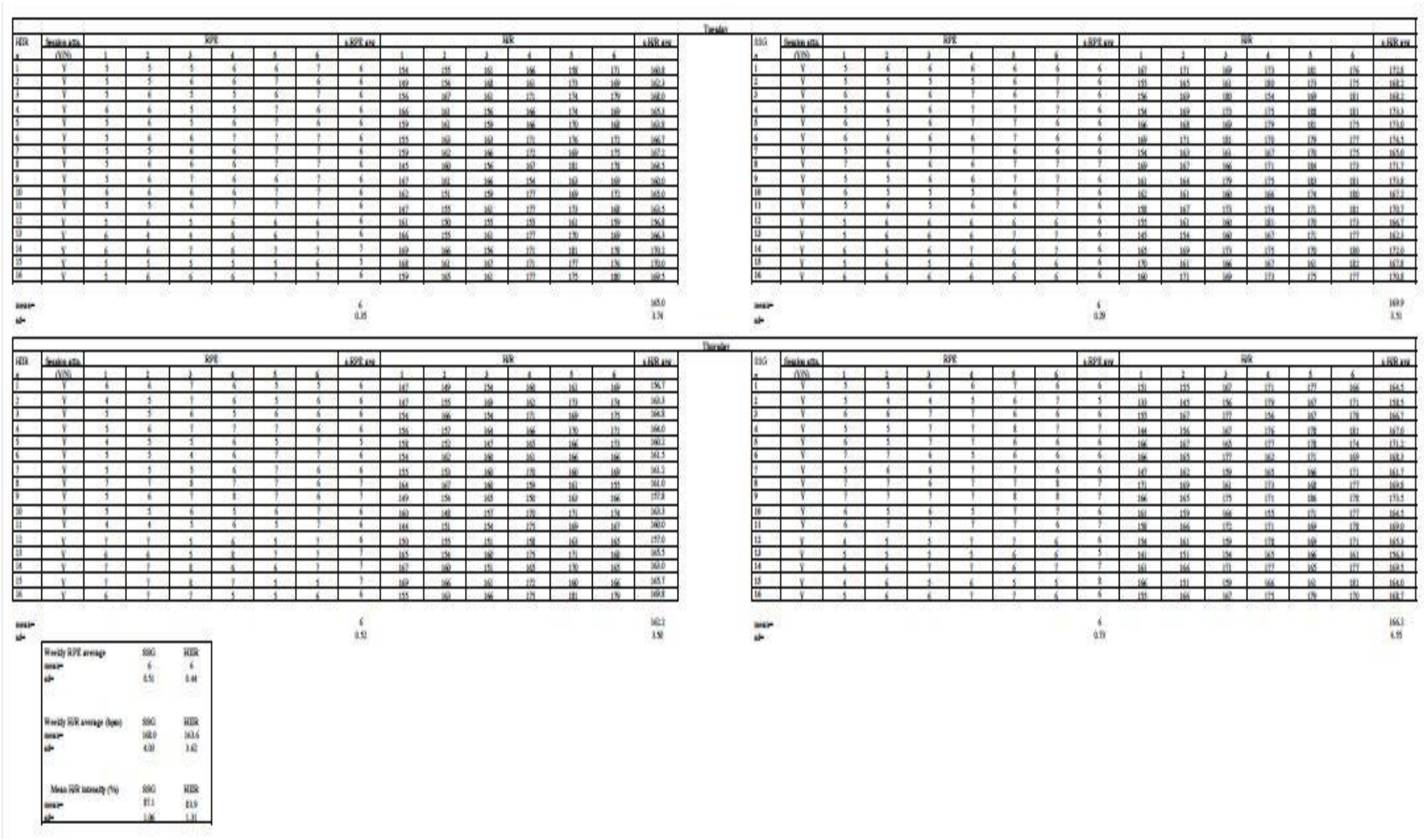
Thursday

HRR	Session nRPE	RPE						s-RPE avg	HR						s-HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	6	7	7	6	7	7	145	156	165	169	171	177	162.7
2	Y	5	5	7	6	5	7	6	139	144	152	148	154	161	149.7
3	Y	5	5	6	6	7	6	6	124	136	146	165	169	171	155.3
4	Y	5	6	7	7	7	6	6	149	154	166	161	158	171	159.8
5	Y	6	5	5	7	6	8	6	130	130	146	141	158	166	141.8
6	Y	5	5	6	6	7	7	6	151	146	166	183	172	178	166.0
7	Y	5	6	5	7	8	7	6	144	154	166	161	178	169	162.0
8	Y	7	7	8	7	7	6	7	159	168	166	182	177	181	172.3
9	Y	5	6	7	8	7	6	7	155	146	160	172	163	166	160.3
10	Y	5	5	6	5	6	7	6	155	159	155	169	161	167	161.0
11	Y	4	4	5	6	5	7	6	147	151	155	158	160	171	155.7
12	Y	7	7	5	7	6	8	7	146	141	159	163	147	154	151.0
13	Y	6	6	5	8	7	7	7	151	148	148	153	161	174	154.5
14	Y	7	7	8	6	6	8	7	138	143	151	163	166	167	151.3
15	Y	8	9	8	8	7	6	8	145	156	147	158	161	177	157.3
16	Y	6	6	7	5	6	6	7	166	170	182	167	169	175	171.5
mean=								6							158.3
s.d=								0.54							7.96

SSG	Session nRPE	RPE						s-RPE avg	HR						s-HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	7	6	5	6	6	6	171	174	179	168	174	175	174.0
2	Y	5	6	6	6	6	6	6	168	171	161	168	173	151	166.2
3	Y	5	6	6	5	6	7	6	157	170	169	164	175	179	169.0
4	Y	5	6	5	6	5	6	6	155	159	148	163	179	181	164.2
5	Y	5	6	6	6	7	6	6	164	171	165	170	177	174	170.3
6	Y	5	6	6	5	6	7	6	157	142	163	149	158	154	153.5
7	Y	5	6	5	6	6	7	6	166	149	161	158	161	151	150.8
8	Y	6	6	5	7	6	7	6	167	151	169	151	157	173	159.2
9	Y	6	6	5	6	6	7	6	155	163	158	151	167	164	153.0
10	Y	5	6	6	6	6	6	6	149	131	140	147	166	163	149.3
11	Y	5	6	6	7	7	7	6	138	131	145	152	167	165	149.7
12	Y	5	5	6	7	7	7	6	161	171	173	178	185	172	173.3
13	Y	5	5	5	6	6	7	6	153	138	150	151	155	161	151.3
14	Y	5	6	6	5	6	7	7	166	154	156	165	177	175	165.5
15	Y	6	6	7	6	7	8	8	153	156	166	167	172	180	166.0
16	Y	5	5	6	6	6	7	6	151	157	158	169	177	173	163.8
mean=								6							161.1
s.d=								0.80							8.67

	SSG	HRR
Weekly RPE average		
mean=	6	6
s.d=	0.50	0.73
Weekly HR average (bpm)	SSG	HRR
mean=	162.2	160.5
s.d=	9.46	7.69
Mean HR intensity (%)	SSG	HRR
mean=	84.1	82.3
s.d=	2.48	2.4

3.3.4 Week 4



Tuesday

HRR	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	5	5	5	6	6	7	6	154	155	161	166	170	171	160.8
2	Y	5	5	6	6	7	6	6	149	154	160	161	171	169	160.3
3	Y	5	6	5	5	6	7	6	156	167	161	171	174	179	168.0
4	Y	6	6	5	5	7	6	6	166	161	156	166	174	169	165.3
5	Y	5	6	5	6	7	6	6	159	161	159	166	170	168	163.8
6	Y	5	6	6	7	7	7	6	155	160	161	171	176	171	166.7
7	Y	5	5	6	6	7	7	6	159	162	166	172	169	175	167.2
8	Y	5	6	6	6	7	7	6	165	160	156	167	181	170	166.5
9	Y	5	6	7	6	6	7	6	147	161	166	154	163	169	160.0
10	Y	6	6	6	6	7	7	6	162	151	159	177	169	171	165.0
11	Y	5	5	6	7	7	7	6	147	155	161	171	171	168	162.5
12	Y	5	6	5	6	6	6	6	161	150	155	155	161	159	156.5
13	Y	6	6	6	6	6	5	6	166	155	161	177	170	169	166.3
14	Y	6	6	7	6	7	7	7	169	166	156	171	181	170	170.1
15	Y	5	5	5	5	5	6	5	168	161	163	171	177	176	170.0
16	Y	5	6	6	6	7	7	6	159	165	161	177	175	180	169.5
mean=								6							165.0
s/n=								0.35							3.78

HRR	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	5	6	6	6	6	6	6	167	171	169	173	181	176	172.8
2	Y	5	5	5	5	6	7	6	155	165	161	169	173	175	168.2
3	Y	6	6	6	7	6	7	6	156	169	180	154	169	181	168.2
4	Y	5	6	6	7	7	7	6	154	169	173	175	188	181	173.3
5	Y	6	5	6	7	7	6	6	166	168	169	179	181	175	173.0
6	Y	6	6	6	6	7	6	6	169	171	181	170	179	177	174.5
7	Y	5	6	7	7	6	6	6	154	163	161	167	170	175	165.0
8	Y	7	6	6	6	7	7	7	169	167	166	171	184	173	171.3
9	Y	5	5	6	6	7	7	6	161	164	179	175	183	181	173.8
10	Y	6	5	5	5	6	7	6	162	161	160	166	174	180	167.2
11	Y	5	6	5	6	6	7	6	158	167	171	174	175	181	170.7
12	Y	5	6	6	6	6	6	6	155	161	160	161	170	171	166.7
13	Y	5	6	6	6	7	7	6	145	154	160	167	175	177	162.2
14	Y	6	6	6	7	6	7	6	165	169	171	175	179	180	172.0
15	Y	5	6	5	6	6	6	6	150	161	166	167	161	181	167.8
16	Y	6	6	6	6	6	6	6	160	171	169	173	175	177	170.8
mean=								6							169.9
s/n=								0.20							1.91

Thursday

HRR	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	6	7	6	5	5	6	147	169	154	160	161	169	156.7
2	Y	4	5	7	6	5	6	6	147	155	169	161	171	174	160.3
3	Y	5	5	6	5	6	6	6	154	166	154	171	169	175	164.8
4	Y	5	6	7	7	7	6	6	156	157	164	166	170	171	166.0
5	Y	4	5	5	6	5	7	5	158	152	147	165	166	171	160.2
6	Y	5	5	4	6	7	7	6	154	162	160	161	166	166	161.5
7	Y	5	5	5	6	7	6	6	155	153	160	170	160	169	161.2
8	Y	7	7	8	7	7	6	7	164	167	160	159	161	151	161.0
9	Y	5	6	7	8	7	6	7	149	156	165	150	160	166	157.8
10	Y	5	5	6	5	6	7	6	160	148	157	170	171	174	163.3
11	Y	4	4	5	6	5	7	6	144	151	154	175	169	167	160.0
12	Y	7	7	5	6	5	7	6	150	155	151	158	163	165	157.0
13	Y	6	6	5	8	7	7	7	165	154	160	175	171	168	165.5
14	Y	7	7	8	6	6	7	7	167	160	151	165	170	165	163.0
15	Y	7	7	8	7	5	5	7	169	166	161	172	160	166	165.7
16	Y	6	7	7	5	5	6	6	155	163	166	179	181	179	169.8
mean=								6							162.1
s/n=								0.52							3.50

HRR	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	5	5	6	6	7	6	6	151	155	167	171	177	166	164.5
2	Y	5	4	4	5	6	7	5	133	145	156	179	167	171	158.5
3	Y	6	6	7	7	6	6	6	155	167	177	156	167	178	166.7
4	Y	5	5	7	7	8	7	7	144	156	167	178	178	181	167.0
5	Y	6	5	7	7	6	6	6	166	167	165	177	178	174	171.3
6	Y	7	7	6	5	6	6	6	166	165	177	167	171	169	169.3
7	Y	5	6	6	7	7	6	6	147	162	159	165	166	171	161.7
8	Y	7	7	6	7	7	8	7	171	169	161	173	168	177	169.5
9	Y	7	7	7	7	8	8	7	166	165	175	171	186	178	173.5
10	Y	6	5	6	5	7	7	6	161	159	166	155	171	171	164.5
11	Y	6	7	7	7	7	6	7	158	166	172	171	169	178	169.0
12	Y	4	5	5	7	7	6	6	154	161	159	178	169	171	165.3
13	Y	5	5	5	5	6	6	5	141	151	154	165	166	161	156.3
14	Y	6	6	7	7	6	7	7	161	166	171	177	165	177	169.5
15	Y	4	6	5	6	5	5	5	166	151	159	166	161	181	164.0
16	Y	5	6	6	7	7	6	6	155	166	167	175	179	170	168.7
mean=								6							166.1
s/n=								0.53							4.55

Weekly RPE average	SSG	HIIR
mean=	6	6
s/n=	0.51	0.44
Weekly HR average (bpm)	SSG	HIIR
mean=	168.0	163.6
s/n=	4.00	3.62
Mean HR intensity (%)	SSG	HIIR
mean=	87.1	84.9
s/n=	1.06	1.31

3.3.5 Week 5

Tuesday

HIIT	Session attn.	RPE						x RPE avg	HR						x HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	4	5	5	7	7	5	155	156	162	168	171	171	166.0
2	Y	4	4	5	6	8	8	6	154	157	162	159	165	172	161.3
3	Y	2	3	4	5	8	8	5	163	171	158	151	167	171	163.5
4	Y	6	5	5	5	6	7	6	159	154	164	176	174	168	166.8
5	Y	5	5	5	6	7	7	6	164	154	164	156	173	176	161.2
6	Y	4	5	6	6	6	7	6	142	139	153	167	178	180	159.8
7	Y	5	5	4	6	7	7	6	154	159	162	171	172	178	165.8
8	Y	5	5	6	7	8	8	7	123	133	132	145	161	167	143.5
9	Y	4	5	5	5	6	8	6	154	160	155	168	171	167	162.5
10	Y	5	6	7	8	7	7	7	136	129	140	149	153	163	145.0
11	Y	5	6	6	7	8	7	7	154	159	166	173	177	178	167.8
12	Y	3	3	4	5	6	6	4	155	147	152	164	170	179	161.2
13	Y	3	2	3	5	6	6	4	131	145	154	161	166	171	154.8
14	Y	3	6	7	6	7	7	6	133	139	143	161	159	169	150.7
15	Y	3	4	5	7	8	8	6	132	144	153	156	169	174	154.7
16	Y	3	4	5	5	6	6	5	159	165	158	169	177	176	166.7
mean=								6							159.2
sd=								0.74							7.45

SSG	Session attn.	RPE						x RPE avg	HR						x HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	6	7	8	7	7	7	154	150	156	167	171	169	161.2
2	Y	5	5	6	7	6	7	6	145	154	166	171	173	173	163.7
3	Y	5	4	5	6	5	6	5	165	175	165	170	181	178	172.3
4	Y	5	6	7	7	7	6	6	153	156	169	167	177	174	169.3
5	Y	6	5	5	7	6	8	6	156	169	167	175	186	176	171.5
6	Y	5	5	4	6	7	7	6	145	159	161	172	178	170	164.2
7	Y	5	6	5	7	8	7	6	150	154	165	177	173	182	166.8
8	Y	7	7	8	7	7	6	7	140	139	151	160	157	174	153.5
9	Y	5	6	7	8	8	6	7	134	145	156	170	161	154	153.0
10	Y	5	5	6	5	6	7	6	154	164	156	170	181	179	167.3
11	Y	6	6	5	6	5	5	5	149	147	155	163	174	173	160.2
12	Y	5	6	6	5	6	5	5	151	147	159	157	161	163	153.0
13	Y	6	5	5	6	7	7	7	153	154	165	170	180	173	165.8
14	Y	5	6	7	8	7	6	7	152	155	158	169	174	173	162.8
15	Y	5	6	5	7	7	6	6	153	161	156	154	169	172	160.5
16	Y	6	5	5	6	7	6	6	162	174	165	174	180	164	169.8
mean=								6							163.4
sd=								0.66							6.29

Thursday

HIIT	Session attn.	RPE						x RPE avg	HR						x HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	5	6	5	6	7	6	6	154	165	159	166	177	169	165.0
2	Y	5	5	5	6	5	5	5	154	167	165	170	177	170	167.2
3	Y	5	4	5	6	5	6	5	153	155	167	175	171	167	165.7
4	Y	5	6	7	7	7	6	6	155	167	171	174	177	176	170.0
5	Y	6	5	5	7	6	8	6	141	135	151	160	161	163	135.2
6	Y	5	5	4	6	7	7	6	147	141	155	160	163	170	156.0
7	Y	5	6	5	7	8	7	6	167	177	179	174	161	177	172.5
8	Y	4	7	8	7	7	6	7	139	142	132	169	151	165	146.5
9	Y	4	6	7	8	8	6	7	142	147	151	159	165	164	154.7
10	Y	3	5	6	5	6	7	5	132	141	145	152	159	163	148.7
11	Y	3	4	5	6	5	5	5	145	150	159	167	159	173	155.5
12	Y	3	4	6	5	6	5	5	139	142	154	156	159	160	151.3
13	Y	6	7	5	8	7	7	7	135	147	144	169	160	163	153.0
14	Y	5	6	7	8	7	8	7	154	163	166	165	174	177	166.5
15	Y	4	4	5	7	7	6	6	165	159	169	172	170	162	166.2
16	Y	4	5	5	6	7	6	6	154	160	169	172	173	179	167.8
mean=								6							160.1
sd=								0.65							8.28

SSG	Session attn.	RPE						x RPE avg	HR						x HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	6	7	8	7	7	7	156	161	171	165	167	169	158.2
2	Y	5	5	6	7	6	7	6	133	139	154	167	161	156	150.0
3	Y	5	4	5	6	5	6	5	131	139	145	154	150	162	147.0
4	Y	5	6	7	7	7	6	6	143	149	156	165	171	169	158.5
5	Y	6	5	5	7	6	8	6	154	145	153	159	166	169	157.7
6	Y	5	5	4	6	7	7	6	151	156	170	169	172	178	165.7
7	Y	5	6	5	7	8	7	6	153	167	175	165	170	174	167.3
8	Y	7	7	8	7	7	6	7	131	160	156	167	181	179	165.7
9	Y	5	6	7	8	8	6	7	159	155	160	173	165	170	164.2
10	Y	5	5	6	5	6	7	6	156	165	170	182	180	175	171.0
11	Y	4	4	5	6	5	5	5	163	154	146	169	172	175	163.2
12	Y	5	4	4	5	6	7	5	153	165	171	181	177	169	169.3
13	Y	6	7	5	8	7	7	7	163	156	161	178	179	177	169.0
14	Y	5	6	7	8	7	8	7	155	155	169	173	185	172	168.3
15	Y	4	4	5	7	7	6	6	166	175	171	181	175	173	173.5
16	Y	4	5	5	6	7	6	6	174	170	171	175	179	165	171.3
mean=								6							163.7
sd=								0.66							7.61

Weekly RPE average	SSG	HIIR
mean=	6	6
sd=	0.66	0.70

Weekly HR average (bpm)	SSG	HIIR
mean=	163.6	159.7
sd=	6.95	7.86

Mean HR intensity (%)	SSG	HIIR
mean=	84.8	81.9
sd=	1.83	3.4

3.3.6 Week 6

Tuesday

HIIT	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	5	6	5	5	6	5	144	139	169	153	160	154	169.8
2	Y	5	4	5	5	6	7	5	139	147	169	160	155	159	154.8
3	Y	4	5	6	5	6	7	6	139	144	156	160	159	164	153.7
4	Y	6	5	5	5	6	7	5	169	171	172	159	166	177	169.0
5	Y	5	6	5	6	5	7	6	156	152	169	157	169	165	161.3
6	Y	5	6	5	5	5	6	5	139	149	151	169	159	161	151.3
7	Y	5	6	5	6	6	7	6	149	145	151	159	166	172	157.0
8	Y	5	6	5	6	7	6	6	138	149	152	148	155	160	150.3
9	Y	6	6	5	5	6	5	5	128	139	147	156	161	154	150.8
10	Y	6	5	7	6	7	6	6	139	138	169	154	164	171	169.2
11	Y	5	6	6	6	7	6	6	147	151	160	177	169	173	162.8
12	Y	4	5	4	5	6	7	5	148	161	157	167	169	175	162.8
13	Y	5	4	6	5	5	6	5	140	139	151	162	149	161	150.3
14	Y	7	6	7	8	7	8	7	161	166	154	166	156	176	159.5
15	Y	5	4	5	7	6	6	6	161	153	154	170	161	173	162.5
16	Y	5	4	7	6	6	7	6	168	159	167	173	176	167	168.3
mean=								6							157.1
sd=								0.52							6.75

SSG	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	5	5	6	5	6	6	159	151	155	161	172	171	161.5
2	Y	5	5	5	6	5	6	5	149	161	155	167	177	171	163.3
3	Y	5	4	6	6	5	5	5	129	161	159	148	165	171	155.3
4	Y	5	5	6	6	6	5	6	144	161	132	176	171	169	158.8
5	Y	5	5	6	7	6	6	6	142	164	166	169	171	180	165.3
6	Y	5	5	4	6	5	5	5	167	175	178	171	168	173	172.0
7	Y	4	5	5	6	5	6	5	136	159	168	169	159	166	156.3
8	Y	6	6	5	7	5	6	6	154	174	165	176	177	181	171.3
9	Y	5	5	6	7	7	6	6	149	180	159	168	172	177	167.5
10	Y	6	5	5	5	6	6	6	165	156	177	167	171	183	169.8
11	Y	5	4	5	5	5	5	5	159	155	166	171	169	175	165.8
12	Y	5	4	4	5	5	6	5	155	161	177	171	169	179	168.7
13	Y	5	4	6	5	6	6	6	166	167	177	170	162	173	169.2
14	Y	5	5	5	6	6	6	6	159	155	151	171	169	175	160.0
15	Y	5	5	5	6	6	6	6	166	151	153	166	174	171	160.3
16	Y	6	6	5	5	6	6	6	155	166	169	177	178	182	171.3
mean=								5							164.8
sd=								0.35							5.51

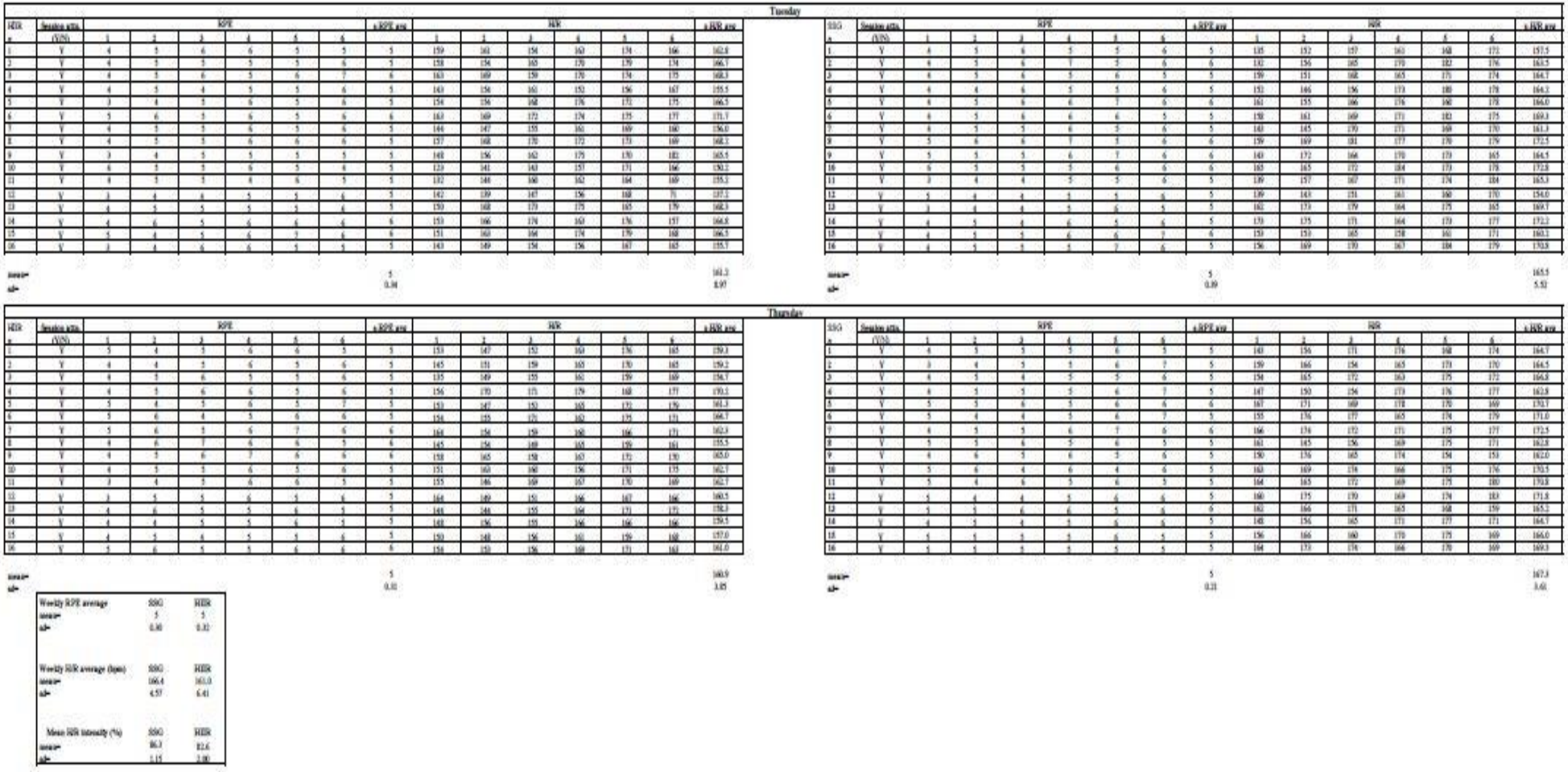
Thursday

HIIT	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	6	5	6	6	6	6	6	155	153	162	161	177	171	163.3
2	Y	6	5	6	6	5	7	6	155	161	159	157	168	171	161.8
3	Y	4	5	6	5	5	6	5	132	149	155	171	169	170	151.7
4	Y	6	5	6	6	5	6	5	156	170	171	179	168	177	170.2
5	Y	5	4	5	6	5	7	5	143	147	153	165	172	169	158.0
6	Y	5	6	4	5	6	6	5	144	155	171	162	175	171	163.0
7	Y	5	5	5	6	7	6	6	152	169	163	178	170	170	166.5
8	Y	6	6	7	6	6	5	6	156	163	156	167	175	171	166.3
9	Y	6	5	6	7	6	6	6	159	163	155	166	173	168	165.8
10	Y	6	6	5	6	5	6	5	131	164	156	163	170	173	156.0
11	Y	6	5	5	6	6	5	5	145	155	169	173	170	174	166.3
12	Y	4	5	5	6	5	6	5	153	156	159	166	168	166	161.3
13	Y	5	6	5	6	6	7	6	163	155	154	174	171	169	166.3
14	Y	6	5	5	6	6	7	6	160	166	153	166	171	166	165.7
15	Y	5	5	6	6	6	7	6	150	162	166	173	163	168	167.8
16	Y	5	5	5	5	6	6	5	142	153	166	171	169	165	161.0
mean=								6							162.9
sd=								0.27							3.69

SSG	Session attn.	RPE						x RPE ave	HR						x HR ave
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	5	4	5	6	6	6	5	131	156	165	171	165	173	160.2
2	Y	6	4	5	6	5	6	5	144	151	166	171	170	169	161.8
3	Y	5	5	4	6	5	6	5	152	166	159	155	171	177	162.3
4	Y	6	5	6	5	6	6	6	150	166	140	181	177	183	166.2
5	Y	5	6	7	6	6	7	6	140	155	167	174	180	183	166.5
6	Y	5	4	4	6	6	6	5	160	159	177	170	165	179	168.3
7	Y	5	5	5	6	7	6	6	140	144	170	171	160	177	160.3
8	Y	6	5	6	7	6	5	6	157	162	176	170	168	169	163.7
9	Y	5	6	5	6	6	7	6	155	172	166	177	169	175	169.0
10	Y	5	6	5	6	5	6	6	149	166	162	163	172	176	165.5
11	Y	6	5	5	5	5	5	5	144	165	170	169	177	179	167.3
12	Y	4	5	4	5	5	6	5	159	177	159	173	169	181	169.8
13	Y	5	6	5	6	7	6	6	149	147	166	167	168	170	157.8
14	Y	5	5	5	6	7	6	6	147	144	148	151	166	171	154.5
15	Y	4	5	4	6	6	6	5	153	155	156	158	167	174	160.5
16	Y	6	5	6	5	6	7	6	151	159	169	167	170	170	165.0
mean=								5							163.7
sd=								0.40							4.30

Weekly RPE average	SSG	HIIT
mean=	5	6
sd=	0.38	0.40
Weekly HR average (bpm)	SSG	HIIT
mean=	166.2	160.0
sd=	4.91	5.22
Mean HR intensity (%)	SSG	HIIT
mean=	85.2	82.1
sd=	1.29	1.63

3.3.7 Week 7



Tuesday

HIIR	Session nRPE	RPE						s-RPE avg	HR						s-HR avg
n	(VIN)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	4	5	6	6	5	5	5	159	161	154	163	174	166	162.8
2	V	4	5	5	5	5	6	5	158	154	165	170	179	154	166.7
3	V	4	5	6	5	6	7	6	163	169	159	170	174	175	168.3
4	V	4	5	4	5	5	6	5	143	158	161	152	156	167	155.5
5	V	3	4	5	6	5	6	5	154	156	162	176	171	175	166.5
6	V	5	6	5	6	5	6	6	163	169	172	174	175	177	171.7
7	V	4	5	5	6	5	6	5	144	147	155	161	169	160	156.0
8	V	4	5	5	6	6	6	5	157	168	170	172	173	169	168.2
9	V	3	4	5	5	5	5	5	148	156	162	175	170	182	165.5
10	V	6	5	5	6	5	6	5	123	141	143	157	171	166	150.2
11	V	4	5	5	4	6	5	5	132	148	160	162	164	169	155.3
12	V	3	4	4	5	5	6	5	142	139	147	156	160	71	127.1
13	V	4	5	5	5	5	6	5	150	168	170	175	165	179	168.3
14	V	4	6	5	6	6	6	6	153	166	174	163	176	157	164.8
15	V	5	4	5	6	5	6	6	151	163	166	174	179	168	166.5
16	V	3	4	6	6	5	5	5	143	149	154	156	167	165	155.7
mean=								5							161.3
sd=								0.34							8.97

SSG	Session nRPE	RPE						s-RPE avg	HR						s-HR avg
n	(VIN)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	4	5	6	5	5	6	5	135	152	157	161	168	171	157.5
2	V	4	5	6	7	5	6	6	132	156	165	170	182	176	163.5
3	V	4	5	6	5	6	5	5	159	151	168	165	175	174	164.7
4	V	4	4	6	5	5	6	5	152	166	156	173	180	178	164.3
5	V	4	5	6	6	7	6	6	161	155	166	176	168	178	166.0
6	V	4	5	6	6	6	5	5	158	161	169	171	182	175	169.3
7	V	4	5	5	6	5	6	5	143	145	150	171	169	170	161.3
8	V	5	6	6	7	5	6	6	159	169	181	177	170	179	172.5
9	V	5	5	5	6	7	6	6	143	172	166	170	173	165	164.5
10	V	6	5	5	5	6	6	6	165	165	172	184	173	178	172.8
11	V	3	4	4	5	5	6	5	139	157	167	171	174	184	165.3
12	V	5	4	4	5	5	6	5	139	143	151	161	160	170	154.0
13	V	3	4	4	5	6	5	5	162	173	179	164	175	165	169.7
14	V	4	5	4	6	5	6	5	153	175	171	164	170	177	172.2
15	V	4	5	5	6	6	7	6	153	153	165	178	161	171	160.1
16	V	4	5	5	5	7	6	5	156	169	170	167	184	179	170.8
mean=								5							165.5
sd=								0.39							5.52

Thursday

HIIR	Session nRPE	RPE						s-RPE avg	HR						s-HR avg
n	(VIN)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	5	4	5	6	6	5	5	153	147	152	161	176	165	159.3
2	V	4	4	5	6	5	6	5	145	151	159	165	170	165	159.2
3	V	4	5	6	5	5	6	5	135	149	155	162	159	169	154.7
4	V	4	5	6	6	5	6	5	156	170	171	179	168	177	170.1
5	V	5	4	5	6	5	7	5	153	147	152	165	172	176	161.3
6	V	5	6	4	5	6	6	5	154	155	171	162	175	171	166.7
7	V	5	6	5	6	7	6	6	164	154	159	168	166	171	162.3
8	V	4	6	7	6	6	5	6	145	156	149	165	159	161	155.5
9	V	4	5	6	7	6	6	6	158	165	158	163	172	170	165.0
10	V	4	5	5	6	5	6	5	151	163	160	156	171	175	162.7
11	V	3	4	5	6	6	5	5	155	146	169	167	170	169	162.7
12	V	3	5	5	6	5	6	5	164	149	151	166	167	166	160.5
13	V	4	6	5	5	6	5	5	148	148	155	164	171	171	158.3
14	V	4	4	5	5	6	5	5	148	156	155	166	166	166	159.5
15	V	4	5	4	5	5	6	5	150	148	156	161	159	160	157.0
16	V	5	6	5	5	6	6	6	154	150	156	168	171	163	161.0
mean=								5							160.9
sd=								0.31							3.05

SSG	Session nRPE	RPE						s-RPE avg	HR						s-HR avg
n	(VIN)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	4	5	5	5	6	5	5	143	156	171	176	168	174	164.7
2	V	3	4	5	5	6	7	5	159	166	156	165	173	170	164.5
3	V	4	5	4	5	5	6	5	154	165	172	163	175	172	166.8
4	V	4	5	5	5	6	7	5	147	150	156	173	176	177	162.8
5	V	5	5	6	5	6	6	6	167	171	169	178	170	169	170.7
6	V	5	4	4	5	6	7	5	155	176	177	165	178	179	171.0
7	V	4	5	5	6	7	6	6	166	174	172	171	175	177	172.5
8	V	5	5	6	5	6	5	5	161	145	156	169	175	171	162.8
9	V	4	6	5	6	5	6	5	150	176	165	174	154	153	162.0
10	V	5	6	4	6	4	6	5	163	169	176	166	175	176	170.5
11	V	5	4	6	5	6	5	5	164	165	172	169	175	180	170.8
12	V	5	4	4	5	6	6	5	160	175	170	169	174	183	171.8
13	V	5	5	6	6	5	6	6	162	166	171	165	168	159	165.2
14	V	4	5	4	5	6	6	5	148	156	165	171	177	171	164.7
15	V	5	5	5	5	6	5	5	156	166	160	170	175	169	166.0
16	V	5	5	5	5	5	5	5	164	173	176	166	170	169	169.3
mean=								5							167.3
sd=								0.21							3.61

Weekly RPE average	SSG	HIIR
mean=	5	5
sd=	0.30	0.32
Weekly HR average (bpm)	SSG	HIIR
mean=	166.4	161.0
sd=	4.57	6.41
Mean HR intensity (%)	SSG	HIIR
mean=	86.3	82.6
sd=	3.15	3.80

3.3.8 Week 8

Tuesday

HIIR	Session nRIs	RPE						s RPE ave	HR						s HR ave
n	(V/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	5	4	5	5	6	5	5	149	152	151	155	163	136	157.7
2	V	4	5	5	5	6	5	5	144	143	159	165	164	154	141.2
3	V	4	6	5	5	5	6	5	168	156	161	176	180	171	168.3
4	V	3	4	5	5	6	6	5	142	150	159	154	163	165	155.5
5	V	4	4	5	5	5	6	5	150	155	160	172	171	181	164.8
6	V	5	6	5	5	6	6	6	145	156	168	169	150	158	150.7
7	V	4	4	5	5	6	6	5	137	139	147	158	159	161	150.2
8	V	4	4	6	6	5	5	5	141	151	151	167	154	155	149.8
9	V	4	4	5	5	6	5	5	132	139	147	152	161	159	146.7
10	V	4	5	5	5	5	6	5	154	166	158	162	172	173	160.7
11	V	4	5	6	5	6	5	5	149	170	164	172	175	169	167.2
12	V	4	5	4	5	6	5	5	151	145	152	156	171	164	156.3
13	V	4	4	5	5	6	5	5	149	159	165	173	171	182	166.5
14	V	4	5	5	5	5	6	5	123	132	144	145	160	154	143.0
15	V	5	4	5	5	6	6	5	149	159	167	171	178	174	166.3
16	V	4	5	6	5	6	6	5	153	159	164	156	165	171	161.3
mean=								5							157.1
sd=								0.25							8.39

SSG	Session nRIs	RPE						s RPE ave	HR						s HR ave
n	(V/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	6	6	5	5	5	5	5	142	153	157	163	171	175	160.2
2	V	6	5	5	6	5	6	5	155	171	159	172	169	172	166.3
3	V	3	4	5	5	6	5	5	154	166	168	177	172	176	168.8
4	V	6	5	5	5	5	6	5	166	154	167	173	181	179	170.7
5	V	3	5	6	5	6	6	5	161	171	169	173	176	169	169.8
6	V	6	6	5	5	5	6	5	158	161	169	171	182	175	169.3
7	V	6	5	5	6	5	6	5	159	167	170	177	169	179	170.2
8	V	6	5	5	6	6	6	5	170	158	167	162	175	171	163.7
9	V	6	5	5	6	6	6	5	161	172	166	175	177	169	169.7
10	V	5	4	5	5	5	6	5	165	157	166	181	178	169	169.0
11	V	6	4	4	5	6	6	5	157	157	167	171	174	184	168.3
12	V	6	5	5	5	5	5	5	154	143	151	161	160	170	156.5
13	V	5	6	5	5	5	5	5	164	156	166	172	177	181	165.5
14	V	6	5	6	5	5	6	5	143	169	171	164	175	183	167.5
15	V	5	6	5	5	6	5	5	142	165	169	162	178	171	164.0
16	V	6	6	5	5	5	5	5	163	169	170	167	188	179	168.7
mean=								5							166.8
sd=								0.25							3.96

Thursday

HIIR	Session nRIs	RPE						s RPE ave	HR						s HR ave
n	(V/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	3	4	5	5	6	5	5	145	144	156	159	161	166	155.2
2	V	4	4	5	5	5	6	5	164	171	167	175	159	175	168.5
3	V	3	5	6	5	6	5	5	135	149	151	161	171	169	156.3
4	V	3	5	6	6	5	6	5	166	156	165	169	167	171	165.7
5	V	4	4	5	6	5	6	5	143	147	152	169	169	169	158.8
6	V	4	6	4	5	6	6	5	144	145	162	162	174	175	160.2
7	V	5	5	5	5	6	6	5	144	154	163	175	167	175	162.3
8	V	3	5	6	6	6	5	5	145	154	169	165	159	171	157.2
9	V	4	5	5	6	6	6	5	158	169	155	167	163	170	160.3
10	V	5	5	5	6	5	6	5	151	158	155	156	167	169	156.5
11	V	4	4	5	6	6	5	5	145	146	159	161	173	174	159.7
12	V	4	5	5	5	5	6	5	144	143	151	155	171	171	156.2
13	V	4	5	6	5	6	5	5	154	160	167	155	151	162	158.2
14	V	3	4	5	5	6	5	5	148	156	155	173	165	171	161.3
15	V	3	4	4	5	6	5	5	150	148	146	151	159	168	158.7
16	V	4	5	6	5	6	5	5	154	153	160	168	165	171	162.7
mean=								5							159.4
sd=								0.25							4.05

SSG	Session nRIs	RPE						s RPE ave	HR						s HR ave
n	(V/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	6	5	6	6	7	7	6	151	161	171	177	175	171	167.7
2	V	3	4	5	5	6	7	5	147	166	161	169	179	175	165.2
3	V	5	5	5	5	6	6	5	154	165	175	160	174	178	167.7
4	V	6	5	6	5	6	7	6	158	169	166	174	175	178	170.0
5	V	5	5	6	5	6	6	6	167	172	167	178	179	174	172.8
6	V	5	4	4	5	6	7	5	165	176	181	165	178	179	172.5
7	V	6	5	5	6	7	6	6	168	171	172	175	181	169	172.7
8	V	5	5	6	5	6	5	5	155	159	160	163	170	175	163.7
9	V	6	5	6	6	6	6	6	169	176	165	175	166	171	167.0
10	V	5	5	6	6	6	6	6	167	169	178	166	175	176	170.5
11	V	6	5	5	6	7	7	6	164	156	171	177	182	175	170.8
12	V	5	4	4	5	6	6	5	160	175	169	172	178	172	171.0
13	V	5	5	6	6	5	6	6	166	155	166	177	173	169	167.3
14	V	4	5	5	6	6	7	6	166	167	177	171	178	172	171.5
15	V	5	5	5	5	6	5	5	166	160	165	169	174	169	167.2
16	V	5	5	5	6	6	6	6	172	177	176	172	186	164	170.8
mean=								5							169.3
sd=								0.36							2.80

Weekly RPE average	SSG	HIIR
mean=	5	5
sd=	0.26	0.25

Weekly HR average (bpm)	SSG	HIIR
mean=	168.0	158.3
sd=	3.38	4.22

Mean HR intensity (%)	SSG	HIIR
mean=	87.1	81.1
sd=	0.88	1.63

3.3.9 Week 9

Tuesday

HIR	Session nRPE (Y/N)	RPE						x-RPE ave	HR						x-HR ave
		1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	5	4	4	5	4	4	169	161	157	159	175	169	165.0
2	Y	6	5	6	5	5	6	5	151	155	161	154	169	169	159.8
3	Y	6	5	6	5	5	5	5	154	161	159	160	149	158	156.8
4	Y	4	5	5	6	5	6	5	142	151	169	162	158	169	155.0
5	Y	4	4	5	5	6	5	5	140	153	164	156	162	170	157.5
6	Y	4	4	6	6	5	6	5	132	140	155	169	155	173	150.7
7	Y	4	5	5	5	6	6	5	140	161	151	166	159	174	158.5
8	Y	5	5	6	6	5	6	6	157	169	160	174	167	175	168.7
9	Y	4	4	5	6	6	6	5	139	146	169	167	158	166	155.3
10	Y	3	4	4	5	4	4	4	156	161	172	171	168	158	164.3
11	Y	5	5	6	6	6	7	6	143	162	176	169	171	169	165.3
12	Y	4	4	4	5	6	6	5	135	156	167	166	173	179	159.0
13	Y	3	4	4	3	4	5	4	151	156	160	151	166	169	159.3
14	Y	3	4	4	5	6	5	5	152	166	173	180	179	174	170.7
15	Y	4	5	5	5	5	4	5	152	169	162	155	169	173	160.0
16	Y	3	3	4	4	5	4	4	151	149	166	156	161	159	157.0
mean=								5							159.7
sd=								0.52							5.06

SSG	Session nRPE (Y/N)	RPE						x-RPE ave	HR						x-HR ave
		1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	5	4	4	5	4	4	128	149	156	160	179	170	156.0
2	Y	5	6	6	5	4	6	5	161	171	181	170	165	172	170.0
3	Y	7	6	6	7	6	6	6	167	171	177	180	171	169	172.5
4	Y	5	6	5	5	5	6	5	155	148	159	166	167	180	161.5
5	Y	6	6	5	6	5	5	6	152	155	167	171	169	177	165.2
6	Y	5	5	6	6	5	6	6	176	173	180	168	159	177	172.1
7	Y	5	5	5	5	5	5	5	142	149	161	166	174	171	160.5
8	Y	6	6	7	5	6	7	6	167	169	171	172	184	179	173.7
9	Y	6	6	5	5	5	6	5	172	164	171	182	188	169	174.3
10	Y	6	6	5	6	6	5	5	168	177	168	154	171	181	166.5
11	Y	6	7	7	8	7	6	7	167	171	179	167	177	182	170.5
12	Y	5	4	4	4	5	5	5	151	154	160	171	168	170	162.8
13	Y	5	6	7	7	7	6	6	167	171	182	186	174	169	174.8
14	Y	5	6	6	5	5	5	5	165	172	169	177	171	171	170.8
15	Y	6	6	6	6	6	5	5	164	154	166	171	177	170	163.7
16	Y	5	5	5	6	6	5	5	158	163	166	171	177	174	167.5
mean=								5							167.7
sd=								0.71							5.61

Thursday

HIR	Session nRPE (Y/N)	RPE						x-RPE ave	HR						x-HR ave
		1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	5	5	4	4	5	6	5	156	161	168	175	169	171	166.3
2	Y	5	5	6	5	5	5	5	158	169	164	155	165	169	160.0
3	Y	4	5	5	5	6	6	5	155	167	151	163	155	166	159.5
4	Y	4	6	5	5	6	6	5	132	159	155	163	157	167	152.3
5	Y	3	4	5	5	5	6	5	151	161	164	172	169	174	165.3
6	Y	3	4	5	5	6	6	5	153	159	169	167	156	166	155.0
7	Y	4	4	5	6	6	7	5	146	151	175	178	168	171	165.0
8	Y	5	6	5	5	6	7	6	147	148	159	173	166	172	160.3
9	Y	3	4	5	6	6	7	5	142	145	150	162	174	178	158.5
10	Y	4	4	5	5	5	6	5	164	176	169	176	156	167	167.7
11	Y	3	3	5	5	5	6	5	259	155	162	165	173	177	182.0
12	Y	3	4	5	6	5	6	5	154	169	167	166	154	65	135.8
13	Y	3	4	5	5	5	4	5	133	142	160	164	159	174	156.3
14	Y	3	4	5	6	5	6	5	157	165	155	165	166	169	159.5
15	Y	3	4	5	5	6	6	5	148	155	171	165	171	165	162.5
16	Y	4	4	4	5	5	6	5	143	165	155	165	177	166	161.8
mean=								5							160.5
sd=								0.51							9.48

SSG	Session nRPE (Y/N)	RPE						x-RPE ave	HR						x-HR ave
		1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	5	5	5	5	6	6	5	165	172	177	169	179	170	172.0
2	Y	5	6	5	6	7	7	6	164	176	169	172	163	175	169.8
3	Y	6	7	6	6	7	7	7	156	172	177	169	174	177	170.8
4	Y	5	5	5	5	6	7	6	162	156	165	177	174	181	168.8
5	Y	5	6	6	6	7	6	6	164	165	171	173	182	185	170.0
6	Y	4	5	5	5	5	6	5	162	164	170	162	177	176	169.5
7	Y	4	5	5	6	7	7	6	162	149	161	166	174	171	160.5
8	Y	6	5	6	5	6	6	6	167	169	171	172	184	179	173.7
9	Y	4	5	6	6	5	6	5	172	164	171	182	188	169	174.3
10	Y	4	5	5	6	6	7	6	156	167	176	169	171	182	170.2
11	Y	5	6	6	7	7	6	6	166	169	175	173	180	177	173.3
12	Y	5	6	6	6	5	5	5	160	162	176	169	174	170	168.5
13	Y	5	6	7	6	7	7	6	171	174	179	167	156	173	170.0
14	Y	4	5	6	5	6	6	5	156	169	175	169	174	176	169.8
15	Y	4	5	6	5	6	6	5	154	166	171	172	180	170	168.8
16	Y	65	5	6	6	6	6	16	167	166	170	171	180	177	172.1
mean=								6							170.2
sd=								2.56							3.15

Weekly RPE average	SSG	HIR
mean=	6	5
sd=	1.64	0.45

Weekly HR average (bpm)	SSG	HIR
mean=	168.9	160.1
sd=	4.48	7.23

Mean HR intensity (%)	SSG	HIR
mean=	87.6	82.1
sd=	1.15	3.57

3.3.10 Week 10

Tuesday

HER	Session attn.	RPE						s.RPE avg	HR						s.HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	5	4	4	5	4	4	169	161	157	159	175	169	165.0
2	Y	6	5	4	5	5	6	5	151	155	161	154	169	169	159.8
3	Y	6	5	4	5	5	5	5	156	161	159	160	149	158	156.8
4	Y	5	4	5	5	6	6	5	147	156	153	162	164	171	158.5
5	Y	6	5	5	6	6	7	6	138	147	169	163	154	169	149.3
6	Y	4	5	4	5	5	6	5	153	156	166	171	169	154	161.2
7	Y	4	4	5	5	6	6	5	139	148	162	154	166	172	156.7
8	Y	5	5	6	6	6	6	6	159	170	174	161	156	166	166.3
9	Y	6	5	6	5	6	6	6	143	156	167	173	171	165	162.5
10	Y	3	4	4	5	6	6	4	156	161	173	171	168	158	166.1
11	Y	5	6	6	5	5	6	6	134	156	163	168	156	171	154.7
12	Y	4	5	6	5	6	5	5	143	164	156	162	159	167	155.0
13	Y	3	4	4	3	4	5	4	151	156	160	153	166	169	159.2
14	Y	5	6	5	6	6	3	6	143	158	168	166	145	165	156.8
15	Y	4	5	6	6	6	6	6	151	166	171	168	173	157	166.1
16	Y	3	3	4	4	5	4	4	161	165	170	156	161	159	162.0
mean=								5							159.4
sd=								0.66							4.39

SSG	Session attn.	RPE						s.RPE avg	HR						s.HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	5	4	4	5	4	4	128	149	156	160	179	170	156.0
2	Y	5	6	6	7	4	6	5	161	171	181	178	165	172	170.0
3	Y	7	6	6	7	6	6	6	167	171	177	180	175	169	172.5
4	Y	5	6	5	5	5	6	5	155	148	159	166	167	180	161.5
5	Y	6	6	5	6	5	5	6	152	155	167	171	169	177	165.2
6	Y	5	5	6	6	5	6	6	136	173	180	168	159	177	172.2
7	Y	5	5	5	5	5	5	5	142	149	161	166	174	171	160.5
8	Y	6	6	7	5	6	7	6	167	169	171	172	184	179	173.7
9	Y	4	4	5	5	5	4	5	172	164	171	182	188	169	174.3
10	Y	4	6	5	6	6	5	5	142	177	148	154	175	181	166.5
11	Y	6	7	7	8	7	6	7	167	171	259	167	177	182	170.5
12	Y	5	4	4	4	5	5	5	151	154	160	171	168	170	162.8
13	Y	5	6	7	7	7	6	6	167	171	182	186	174	169	174.8
14	Y	5	6	6	5	5	5	5	165	172	169	177	175	171	170.8
15	Y	6	6	6	6	5	5	5	164	154	166	171	177	170	163.7
16	Y	5	5	5	6	6	5	5	154	163	166	171	177	174	167.5
mean=								5							167.1
sd=								0.71							5.61

Thursday

HER	Session attn.	RPE						s.RPE avg	HR						s.HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	5	5	5	6	6	5	132	148	145	156	140	165	146.0
2	Y	4	5	5	5	6	6	5	143	150	153	141	141	147	145.8
3	Y	4	4	5	5	6	6	5	123	137	143	154	155	160	145.3
4	Y	5	5	6	6	6	6	6	138	140	151	159	147	148	147.1
5	Y	4	4	6	6	6	6	5	141	155	151	160	161	163	155.1
6	Y	5	6	5	5	6	6	6	155	159	162	167	170	175	166.7
7	Y	4	5	5	6	6	6	5	139	142	152	155	163	166	152.7
8	Y	4	5	5	6	5	6	5	144	143	159	145	144	154	148.3
9	Y	4	5	6	6	6	7	6	137	148	161	154	151	171	153.3
10	Y	4	5	4	5	6	7	5	142	150	159	154	163	165	155.5
11	Y	5	5	6	6	6	6	6	132	145	140	165	171	163	152.7
12	Y	5	5	5	5	5	5	5	145	156	168	169	150	158	150.7
13	Y	4	4	4	5	6	6	5	156	159	164	155	168	150	161.7
14	Y	6	5	6	5	6	6	6	161	170	171	169	165	175	168.5
15	Y	3	4	5	5	5	6	5	169	159	164	170	166	173	166.0
16	Y	4	5	5	6	6	6	5	170	167	171	165	159	169	167.3
mean=								5							155.1
sd=								0.31							8.19

SSG	Session attn.	RPE						s.RPE avg	HR						s.HR avg
n	(Y/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	Y	4	5	4	5	5	6	5	142	155	157	165	174	175	161.3
2	Y	6	5	5	6	6	7	6	156	171	162	172	169	173	167.3
3	Y	6	5	6	7	6	7	6	157	166	171	175	179	169	169.5
4	Y	6	5	5	5	6	6	5	168	156	171	177	180	179	172.0
5	Y	6	5	5	6	7	6	6	167	72	177	181	173	178	158.0
6	Y	3	4	5	6	7	7	5	170	129	172	182	177	180	168.3
7	Y	5	5	5	5	5	5	5	171	175	182	180	174	171	175.5
8	Y	5	6	5	6	6	6	6	169	174	171	174	177	180	174.2
9	Y	6	4	5	6	6	6	5	169	173	176	169	164	177	171.3
10	Y	6	5	5	5	5	6	5	156	171	177	181	169	172	171.0
11	Y	5	6	6	7	6	7	6	171	169	176	172	182	179	174.8
12	Y	6	5	6	6	7	7	6	175	172	182	178	172	181	176.0
13	Y	6	5	5	6	6	7	6	171	173	169	161	172	176	170.3
14	Y	6	5	6	6	5	6	5	172	178	172	169	171	180	173.7
15	Y	6	5	5	6	7	6	6	163	167	179	177	171	179	171.7
16	Y	5	5	5	5	5	5	5	161	170	165	171	177	179	170.5
mean=								5							170.4
sd=								0.35							6.95

Weekly RPE average	SSG	HER
mean=	5	5
sd=	0.53	0.49

Weekly HR average (bpm)	SSG	HER
mean=	169.0	157.2
sd=	5.28	6.29

Mean HR intensity (%)	SSG	HER
mean=	87.7	80.6
sd=	3.05	2.44

Appendix 4

SPSS statistical analysis data

4.1 Descriptive Analysis

	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	32
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=Groups Age Hgt Wgt Body_Fat YO_YO_IR1 /HISTOGRAM NORMAL /ORDER=ANALYSIS.
Resources	Processor Time	00:00:06.59
	Elapsed Time	00:00:03.95

[DataSet1] E:\MOC_SPSS.sav

Statistics

		Groups	Pre-Age (yrs)	Pre-Hgt (cm)	Pre-Wgt (kg)	Pre-BF %
N	Valid	32	32	32	32	32
	Missing	0	0	0	0	0

Statistics

		Pre-YO_YO IR1 (m)
N	Valid	32
	Missing	0

Frequency Table

Groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SSG	16	50.0	50.0	50.0
	HIIR	16	50.0	50.0	100.0
	Total	32	100.0	100.0	

Pre-Agr (yrs)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19.00	1	3.1	3.1	3.1
	20.00	1	3.1	3.1	6.3
	21.00	2	6.3	6.3	12.5
	23.00	3	9.4	9.4	21.9
	24.00	3	9.4	9.4	31.3
	25.00	4	12.5	12.5	43.8
	26.00	6	18.8	18.8	62.5
	27.00	2	6.3	6.3	68.8
	28.00	2	6.3	6.3	75.0
	29.00	3	9.4	9.4	84.4
	31.00	2	6.3	6.3	90.6
	32.00	1	3.1	3.1	93.8
	33.00	1	3.1	3.1	96.9
	34.00	1	3.1	3.1	100.0
	Total	32	100.0	100.0	

Pre-Hgt (cm)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	170.00	3	9.4	9.4	9.4
	172.00	1	3.1	3.1	12.5
	175.00	4	12.5	12.5	25.0
	175.50	2	6.3	6.3	31.3
	177.00	4	12.5	12.5	43.8
	178.00	1	3.1	3.1	46.9
	179.00	1	3.1	3.1	50.0
	180.00	6	18.8	18.8	68.8
	182.00	3	9.4	9.4	78.1
	183.00	2	6.3	6.3	84.4
	185.00	1	3.1	3.1	87.5
	186.00	1	3.1	3.1	90.6
	187.50	1	3.1	3.1	93.8
	188.00	1	3.1	3.1	96.9
	192.00	1	3.1	3.1	100.0
	Total	32	100.0	100.0	

Pre-Wgt (kg)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	64.50	1	3.1	3.1	3.1
	69.00	1	3.1	3.1	6.3
	70.40	1	3.1	3.1	9.4
	75.00	2	6.3	6.3	15.6
	78.00	4	12.5	12.5	28.1
	78.90	1	3.1	3.1	31.3
	79.00	2	6.3	6.3	37.5
	80.00	3	9.4	9.4	46.9
	81.40	1	3.1	3.1	50.0
	82.00	1	3.1	3.1	53.1
	83.00	2	6.3	6.3	59.4
	84.00	3	9.4	9.4	68.8

	86.00	3	9.4	9.4	78.1
	87.00	2	6.3	6.3	84.4
	87.10	1	3.1	3.1	87.5
	89.00	1	3.1	3.1	90.6
	90.00	1	3.1	3.1	93.8
	91.00	1	3.1	3.1	96.9
	110.00	1	3.1	3.1	100.0
	Total	32	100.0	100.0	

Pre-BF %

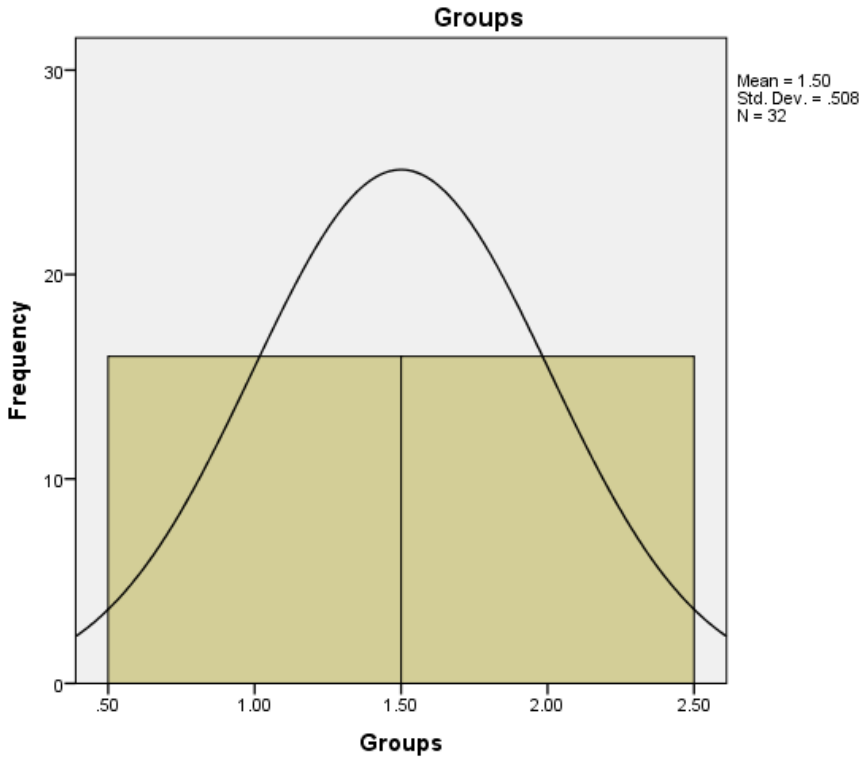
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7.80	1	3.1	3.1	3.1
	8.50	1	3.1	3.1	6.3
	9.10	1	3.1	3.1	9.4
	9.40	1	3.1	3.1	12.5
	9.90	1	3.1	3.1	15.6
	10.50	1	3.1	3.1	18.8
	10.70	2	6.3	6.3	25.0
	10.90	1	3.1	3.1	28.1
	11.00	1	3.1	3.1	31.3
	11.30	1	3.1	3.1	34.4
	11.70	2	6.3	6.3	40.6
	11.80	1	3.1	3.1	43.8
	12.00	1	3.1	3.1	46.9
	12.20	1	3.1	3.1	50.0
	12.50	1	3.1	3.1	53.1
	12.90	2	6.3	6.3	59.4
	13.20	2	6.3	6.3	65.6
	13.40	1	3.1	3.1	68.8
	13.70	1	3.1	3.1	71.9
	13.80	1	3.1	3.1	75.0
	14.50	1	3.1	3.1	78.1
	14.60	2	6.3	6.3	84.4
	15.00	1	3.1	3.1	87.5
	15.20	1	3.1	3.1	90.6
	15.60	1	3.1	3.1	93.8

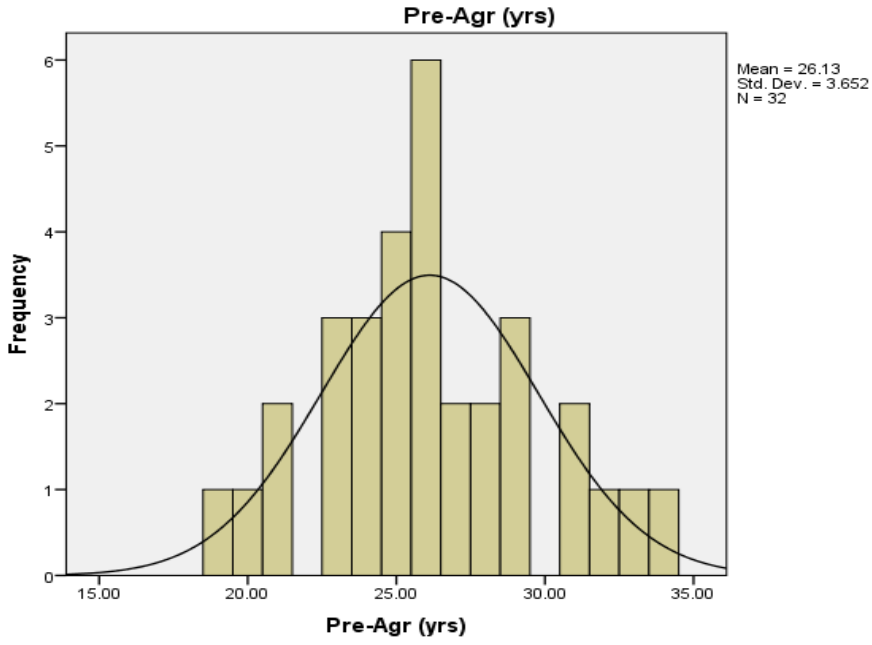
	16.50	1	3.1	3.1	96.9
	17.20	1	3.1	3.1	100.0
	Total	32	100.0	100.0	

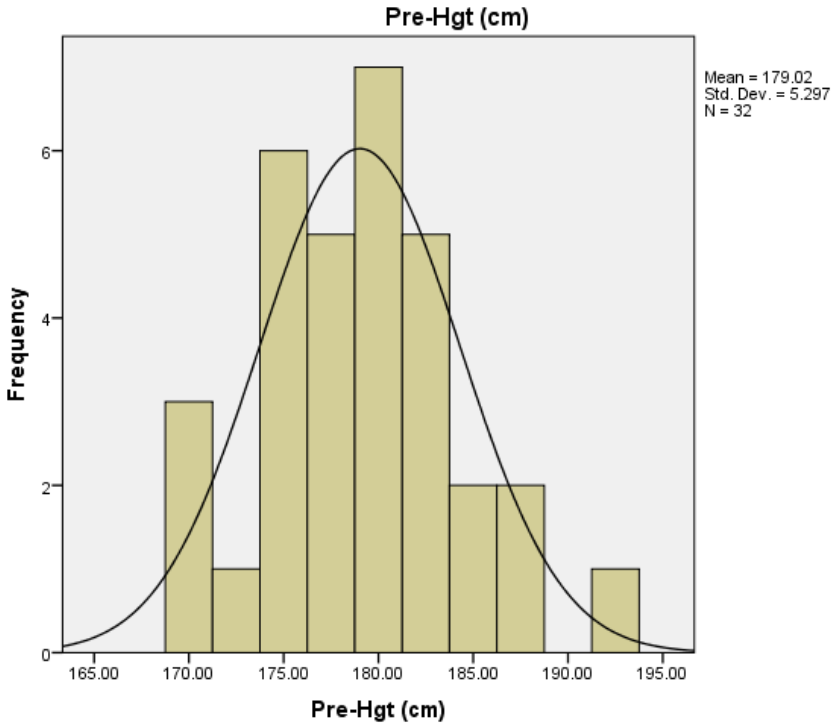
Pre-YO_YO IR1 (m)

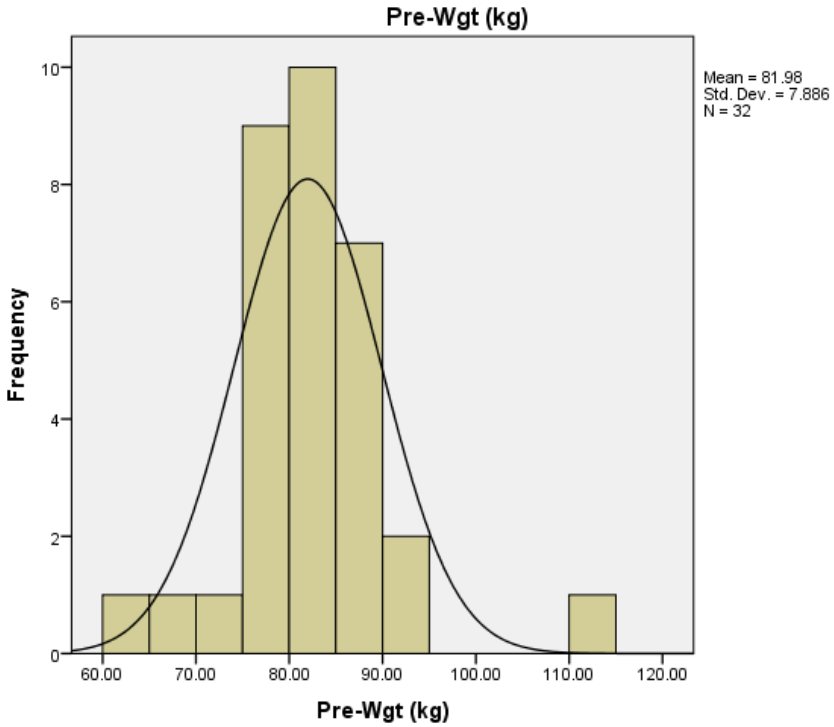
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	320.00	1	3.1	3.1	3.1
	400.00	1	3.1	3.1	6.3
	520.00	1	3.1	3.1	9.4
	600.00	1	3.1	3.1	12.5
	640.00	1	3.1	3.1	15.6
	1000.00	2	6.3	6.3	21.9
	1120.00	1	3.1	3.1	25.0
	1160.00	1	3.1	3.1	28.1
	1220.00	1	3.1	3.1	31.3
	1240.00	1	3.1	3.1	34.4
	1280.00	2	6.3	6.3	40.6
	1320.00	1	3.1	3.1	43.8
	1360.00	2	6.3	6.3	50.0
	1380.00	1	3.1	3.1	53.1
	1400.00	2	6.3	6.3	59.4
	1440.00	1	3.1	3.1	62.5
	1560.00	2	6.3	6.3	68.8
	1720.00	2	6.3	6.3	75.0
	1740.00	1	3.1	3.1	78.1
	1800.00	1	3.1	3.1	81.3
	1880.00	1	3.1	3.1	84.4
	1920.00	3	9.4	9.4	93.8
	2040.00	1	3.1	3.1	96.9
	2240.00	1	3.1	3.1	100.0
	Total	32	100.0	100.0	

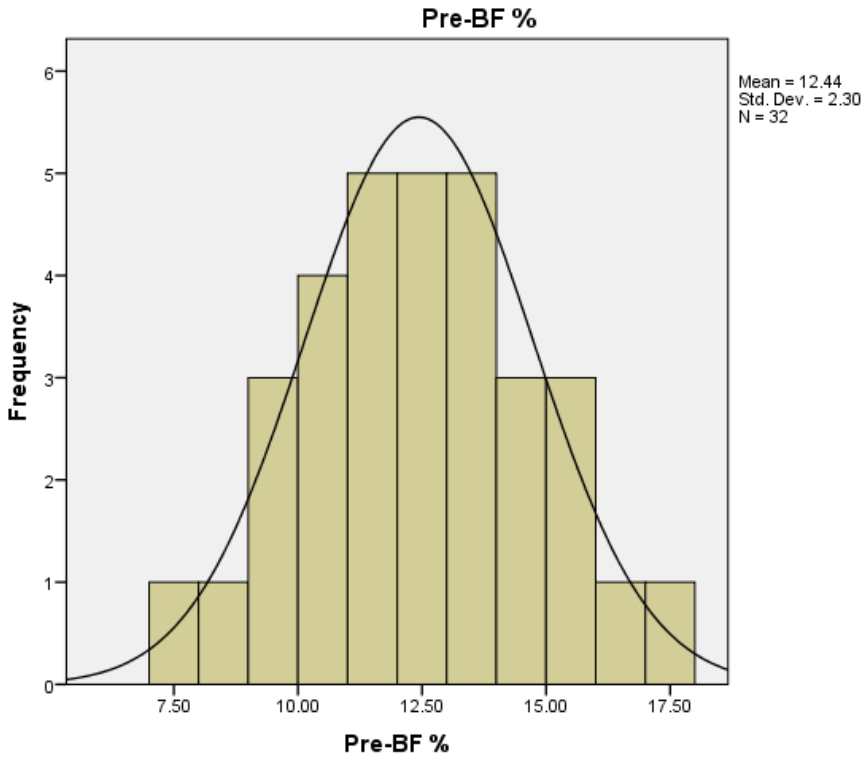
Histogram

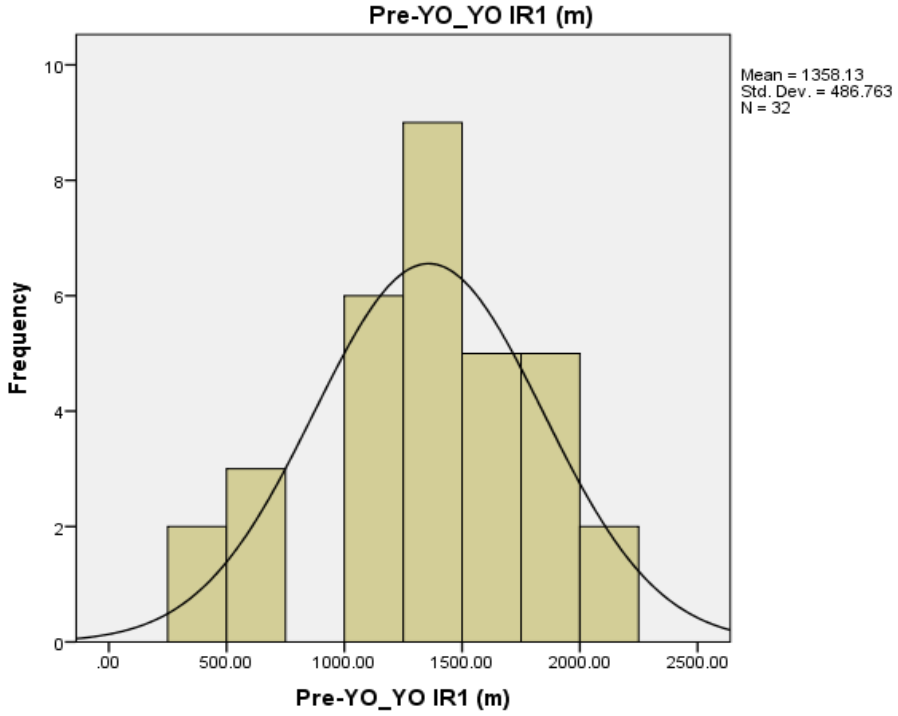

Groups
Mean = 1.50
Std. Dev. = .508
N = 32
Frequency
30
20
10
0
.50
1.00
1.50
2.00
2.50
Groups


Pre-Agr (yrs)
Mean = 26.13
Std. Dev. = 3.652
N = 32
Frequency
6
5
4
3
2
1
0
15.00
20.00
25.00
30.00
35.00
Pre-Agr (yrs)


Pre-Hgt (cm)
Mean = 179.02
Std. Dev. = 5.297
N = 32
Frequency
0
2
4
6
165.00
170.00
175.00
180.00
185.00
190.00
195.00
Pre-Hgt (cm)


Pre-Wgt (kg)
Mean = 81.98
Std. Dev. = 7.886
N = 32
Frequency
0
2
4
6
8
10
60.00
70.00
80.00
90.00
100.00
110.00
120.00
Pre-Wgt (kg)


Pre-BF %
Mean = 12.44
Std. Dev. = 2.30
N = 32
Frequency
0
1
2
3
4
5
6
7.50
10.00
12.50
15.00
17.50
Pre-BF %


Pre-YO_YO IR1 (m)
Mean = 1358.13
Std. Dev. = 486.763
N = 32
Frequency
0
2
4
6
8
10
.00
500.00
1000.00
1500.00
2000.00
2500.00
Pre-YO_YO IR1 (m)

4.2 Test of Normality

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-Wgt (kg)	0.151	32	0.062	0.904	32	0.008
Post-Wgt (kg)	0.103	32	.200*	0.970	32	0.512
Pre-BF %	0.065	32	.200*	0.992	32	0.996
Post- BF%	0.081	32	.200*	0.985	32	0.932
Pre-1km TT (sec)	0.184	32	0.007	0.931	32	0.042
Post-1km TT (sec)	0.146	32	0.081	0.945	32	0.102
Pre-MAS (m/s)	0.130	32	0.186	0.957	32	0.227
Post-MAS (m/s)	0.115	32	.200*	0.967	32	0.416
Pre-YO_YO IR1 (m)	0.107	32	.200*	0.958	32	0.244
Post-YO_YO IR1 (m)	0.140	32	0.115	0.941	32	0.080
Pre-Vo2 max (ml/kg/min)	0.107	32	.200*	0.958	32	0.245
Post- Vo2 max (ml/kg/min)	0.140	32	0.115	0.941	32	0.080
Pre-Acc 10m (s)	0.110	32	.200*	0.966	32	0.407
Post_Acc_10m (s)	0.078	32	.200*	0.979	32	0.777
Pre-RSA Total (s)	0.190	32	0.005	0.904	32	0.008
Post-RSA Total (s)	0.103	32	.200*	0.965	32	0.376
Pre-RSA_Avg (s)	0.187	32	0.006	0.904	32	0.008
Post-RSA_Avg (s)	0.151	32	0.062	0.917	32	0.017
Pre-FI %	0.095	32	.200*	0.956	32	0.216
Post_Fatigue_Index (%)	0.189	32	0.005	0.840	32	0.000

*. This is a lower bound of the true significance.

4.3 Two-Way ANOVA test

Within-Subjects Factors

Measure:

Time
1
2

Between-Subjects Factors

Groups

Descriptive Statistics

Groups
Pre-F I %
Post_Fatigue_Index (%)

Multivariate Tests[a]

Effect

Time	
Time * Groups	

a. Design: Intercept + Groups
Within Subjects Design: Time

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure:

Within Subjects Effect	
Time	

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + Groups
Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure:

Source
Time
Time * Groups
Error(Time)

Tests of Within-Subjects Contrasts

Measure:

Source
Time
Time * Groups
Error(Time)

Tests of Between-Subjects Effects

Measure:

Transformed Variable:

Source
Intercept
Groups
Error

Estimated Marginal Means

1. Grand Mean

Measure:

Mean
4.136

2. Groups * Time

Measure:

Groups
SSG
HIIR

3. Groups

Estimates

Measure:

Groups
SSG
HIIR

Pairwise Comparisons

Measure:

(I) Groups
SSG
HIIR

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Measure:

Contrast

Error

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

4. Time

Estimates

Measure:

Time
1
2

Pairwise Comparisons

Measure:

(I) Time
1
2

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

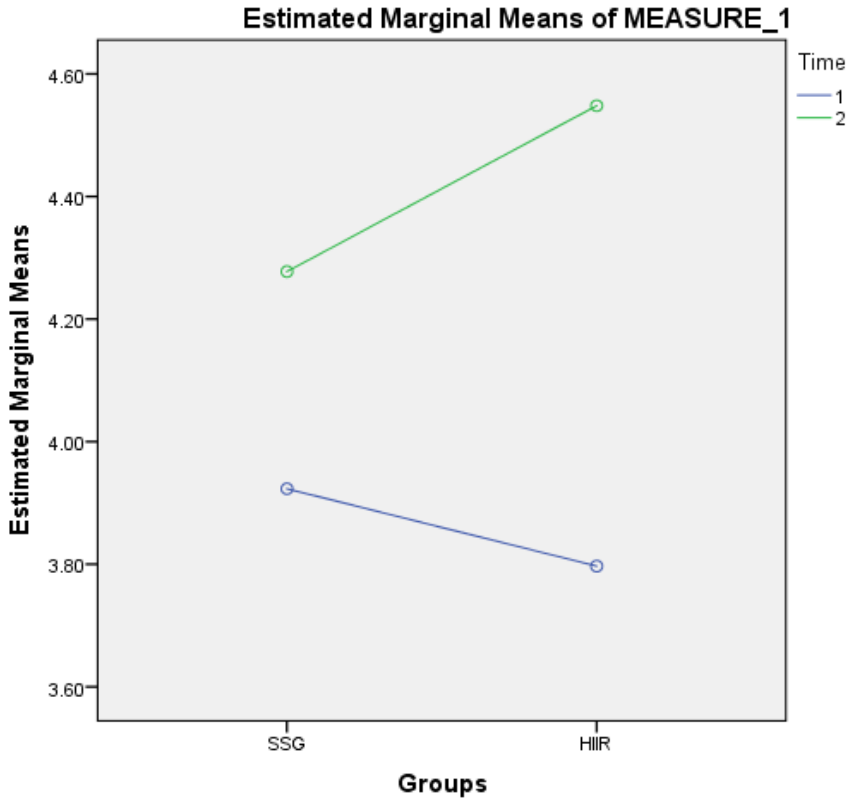
Multivariate Tests

Pillai's trace
Wilks' lambda
Hotelling's trace
Roy's largest root

Each F tests the multivariate effect of Time. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Profile Plots



Measure:	MEASURE_1
Time	Dependent Variable
1	Acc_10m
2	Post_Acc_10m

Between-Subjects Factors

		Value Label	N
Groups	1.00	SSG	16
	2.00	HIIR	16

Descriptive Statistics

Groups		Mean	Std. Deviation	N
Pre-Acc 10m (s)	SSG	2.2100	0.16358	16
	HIIR	2.2213	0.14156	16
	Total	2.2156	0.15059	32
Post_Acc_10m (s)	SSG	2.1781	0.13383	16
	HIIR	2.1806	0.09490	16
	Total	2.1794	0.11413	32

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
Time	Pillai's Trace	0.137	4.758[b]	1.000	30.000	0.037
	Wilks' Lambda	0.863	4.758[b]	1.000	30.000	0.037

	Hotelling's Trace	0.159	4.758[b]	1.000	30.000	0.037
	Roy's Largest Root	0.159	4.758[b]	1.000	30.000	0.037
Time * Groups	Pillai's Trace	0.002	.069[b]	1.000	30.000	0.794
	Wilks' Lambda	0.998	.069[b]	1.000	30.000	0.794
	Hotelling's Trace	0.002	.069[b]	1.000	30.000	0.794
	Roy's Largest Root	0.002	.069[b]	1.000	30.000	0.794

a. Design: Intercept + Groups
Within Subjects Design: Time

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

					Epsilon[b]		
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	1.000	0.000	0		1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + Groups
Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Sphericity Assumed	0.021	1	0.021	4.758	0.037
	Greenhouse-Geisser	0.021	1.000	0.021	4.758	0.037
	Huynh-Feldt	0.021	1.000	0.021	4.758	0.037
	Lower-bound	0.021	1.000	0.021	4.758	0.037
Time * Groups	Sphericity Assumed	0.000	1	0.000	0.069	0.794
	Greenhouse-Geisser	0.000	1.000	0.000	0.069	0.794
	Huynh-Feldt	0.000	1.000	0.000	0.069	0.794
	Lower-bound	0.000	1.000	0.000	0.069	0.794
Error(Time)	Sphericity Assumed	0.133	30	0.004		
	Greenhouse-Geisser	0.133	30.000	0.004		
	Huynh-Feldt	0.133	30.000	0.004		
	Lower-bound	0.133	30.000	0.004		

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Linear	0.021	1	0.021	4.758	0.037
Time * Groups	Linear	0.000	1	0.000	0.069	0.794
Error(Time)	Linear	0.133	30	0.004		

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	309.056	1	309.056	9527.567	0.000
Groups	0.001	1	0.001	0.023	0.880
Error	0.973	30	0.032		

Estimated Marginal Means

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
2.198	0.023	2.152	2.243

2. Groups * Time

Measure: MEASURE_1

Groups		Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
SSG	1	2.210	0.038	2.132	2.288
	2	2.178	0.029	2.119	2.237
HIIR	1	2.221	0.038	2.143	2.299
	2	2.181	0.029	2.121	2.240

3. Groups

Estimates

Measure: MEASURE_1

Groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
SSG	2.194	0.032	2.129	2.259
HIIR	2.201	0.032	2.136	2.266

Pairwise Comparisons

Measure: MEASURE_1

(I) Groups		Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
SSG	HIIR	-0.007	0.045	0.880	-0.099	0.085
HIIR	SSG	0.007	0.045	0.880	-0.085	0.099

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Measure: MEASURE_1

	Sum of Squares	df	Mean Square	F	Sig.

Contrast	0.000	1	0.000	0.023	0.880
Error	0.487	30	0.016		

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

4. Time

Estimates

Measure: MEASURE_1

			95% Confidence Interval	
Time	Mean	Std. Error	Lower Bound	Upper Bound
1	2.216	0.027	2.160	2.271
2	2.179	0.021	2.137	2.221

Pairwise Comparisons

Measure: MEASURE_1

					95% Confidence Interval for Difference[b]	
(I) Time		Mean Difference (I-J)	Std. Error	Sig.[b]	Lower Bound	Upper Bound
1	2	.036*	0.017	0.037	0.002	0.070
2	1	-.036*	0.017	0.037	-0.070	-0.002

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.
Pillai's trace	0.137	4.758[a]	1.000	30.000	0.037
Wilks' lambda	0.863	4.758[a]	1.000	30.000	0.037
Hotelling's trace	0.159	4.758[a]	1.000	30.000	0.037
Roy's largest root	0.159	4.758[a]	1.000	30.000	0.037

Each F tests the multivariate effect of Time. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Profile Plots